Registered at the G.P.O. for Transmission to Canada and Newfoundland by Magazine Post.

VOL. 22. Ser. A. Part 6.—pp. 273–344. JUNE, 1934.

THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

ISSUED BY THE IMPERIAL INSTITUTE OF ENTOMOLOGY.

LONDON:
THE IMPERIAL INSTITUTE OF ENTOMOLOGY,
41, QUEEN'S GATE, S.W.7.

Price 2s. net.

All Rights Reserved.

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

Sir CHARLES J. HOWELL THOMAS, K.C.B., K.C.M.G., *Chairman*, United Kingdom.

Colonel GEORGE P. VANIER, D.S.O., M.C., Canada.

F. L. MCDOUGALL, C.M.G., Australia.

NEVILL L. WRIGHT, F.I.C., New Zealand.

G. W. KLERCK, South Africa.

J. M. ADAMS, F.R.C.Sc. (I), Irish Free State.

Sir BHUPENDRA NATH MITRA, K.C.S.I., K.C.I.E., C.B.E., India.

B. F. WRIGHT, Southern Rhodesia.

R. V. VERNON, C.B., Colonies, Protectorates and Mandated Territories.

Sir DAVID CHADWICK, C.S.I., C.I.E., *Secretary*.

Director.
Sir GUY A. K. MARSHALL, C.M.G., F.R.S.

Assistant Director and Editor.
Dr. S. A. NEAVE, O.B.E.

Assistant Director and
Superintendent of Farnham House Laboratory.
Dr. W. R. THOMPSON, F.R.S.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.

Vol. LXX (LITERATURE OF 1933). *READY IN JULY.*

ZOOLOGICAL RECORD—PART INSECTA.

The "Insecta" part of the "Zoological Record" (as distinguished from the complete volume) is now published by, and only obtainable from, the Imperial Institute of Entomology.

Owing to the lack of support given to the experiment of breaking the part up into five separate sections, which has been carried on since Vol. LXI, it has been decided to discontinue this, beginning with Vol. LXVIII (literature of 1931), which appeared in July 1932. The "Insecta" part will now therefore only be obtainable in the complete form, except in the case of certain sections of Vols. LXI–LXVII. The price of the part will be as before, *viz.*:—15/6 post free.

All orders for the "Insecta" part should be addressed to *The Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.*

Orders for the complete volume of the "Zoological Record" should be sent to the Zoological Society of London, Regent's Park, London, N.W.8.

REVISTA DE ENTOMOLOGIA

An International Review of Entomology

An illustrated magazine published four times a year by **THOMAZ BORGMEIER, O.F.M.,** devoted to entomology, mainly of the neotropical fauna.

The three volumes already published (1931–1933) comprise more than 1,500 pages and contain articles by leading entomologists as W. M. Wheeler, F. W. Edwards, W. Horn, E. Lindner, E. Martini, A. da Costa Lima, F. Silvestri, C. Menozzi, A. Reichensperger, F. Santschi, D. Moulton, etc., with a bibliography of the current literature (economic and non-economic) of the neotropical fauna.

Price to subscribers in Europe 16 Reichsmark, outside Europe 4 U.S. dollars, payable in advance. Volumes 1–3 are still on sale; price of each volume 4 U.S. dollars.

Subscriptions should be sent to the Editor: Thomaz Borgmeier, O.F.M., Convento S. Antonio, Largo da Carioca, Rio de Janeiro, Brazil; *or* to: Adolf Schlüter, Kuhlenstrasse 45, Minden i. W., Germany.

ENTOMOLOGICAL LITERATURE

LARGEST STOCK IN THE WORLD

of Books, Serials, and Pamphlets, in all languages, relating to INSECTS, SPIDERS, MITES & TICKS.

CATALOGUES ON APPLICATION

Liberal allowances in cash or exchange will be made for authors' reprints, and other works of entomological interest.

JOHN D. SHERMAN, JR.,
132 PRIMROSE AVENUE, MOUNT VERNON, NEW YORK.

THIRD EDITION, REVISED

A General Text-Book of Entomology

INCLUDING THE ANATOMY, PHYSIOLOGY, DEVELOPMENT AND CLASSIFICATION OF INSECTS

By A. D. IMMS, M.A., D.Sc., F.R.S.
University Reader in Entomology, Cambridge

With over 600 illustrations. **36/-** net

" Dr. Imm's Text-book should certainly be in the hands of all working students, who will find therein information on any or every branch of entomology, more particularly on the anatomical and physiological aspects of the subject."

—*Entomologists' Monthly Magazine.*

METHUEN & CO., LTD., 36, Essex Street, London, W.C.2

PYRETHRUM PREPARATIONS

Stafford Allen & Sons, Ltd., have undertaken original research on pyrethrum, and are in a position to supply biologically tested liquid extracts, powders, etc., of pyrethrum for horticultural and agricultural insecticides.

ENQUIRIES INVITED.

STAFFORD ALLEN & SONS, LTD.,
Manufacturing Chemists. *Established 1833.*
COWPER STREET : : LONDON, E.C.2.

FEYTAUD (J.). **La courtilière** (*Gryllotalpa gryllotalpa* **L.**).—*Rev. Zool. agric.* **32** nos. 6–12, pp. 99–108, 109–122, 125–133, 141–146, 157–171, 173–188, 193–199, 15 figs., 87 refs. Bordeaux, June–December 1933.

The external and internal morphology of the adults of *Gryllotalpa gryllotalpa*, L., and its bionomics in France, where it is very destructive, are discussed in detail. The remedial measures practised are reviewed, those recommended by the author being: protection of plants by collars of metal or cardboard; the opening up of the burrows and destruction of the immature stages; trapping the adults in manure heaps during the winter or by means of light-traps during the flight period; treatment of the soil with naphthalene or crude ammonia as a repellent; fumigation with carbon bisulphide; and the use of poison baits [*R.A.E.*, A **20** 257, etc.].

BUA (G.). **Risultato di alcuni esperimenti con varie sostanze per catturare** *Ceratitis*. [The Result of some Experiments with various Substances to capture *Ceratitis*.]—*Ann. R. Ist. sup. agrar. Portici* (3) **6** pp. 116–124. Portici, 1934.

Of various substances tested as baits for *Ceratitis capitata*, Wied., in pans and trap-jars [*R.A.E.*, A **18** 179] hung in trees in the Province of Salerno, the most effective was water in which bran (1 : 10) had been soaked for 1–2 days in a warm place not exposed to direct sunshine until the bran floated up and a smell of fermentation became perceptible [*cf.* **22** 228]. The liquid was then strained through a cloth. If left until putrefaction set in, it was less attractive. Water in which sliced dried figs (1 : 10) or sliced potatoes or carob beans [*Ceratonia siliqua*] (1 : 5) had been fermented and one of two aromatic vinegars merited further trial.

BUDDIN (W.). **The Canker and the Dry Rot Diseases of Swedes.**—*Bull. Minist. Agric.* no. 74, v+47 pp., 8 pls., 36 refs. London, H.M.S.O., January 1934. Price 1*s*.

No evidence was observed during investigations in England from the autumn of 1927 to the summer of 1931 that *Drosophila buscki*, Cogwill (*rubrostriata*, Beck., *plurilineata*, Villen.) [*cf. R.A.E.*, A **21** 30, 205; etc.], which was observed in swede fields in Dorset, or any other insect is an important factor in the spread of *Phoma lingam*, the cause of canker in the seed-bearing crops of swedes and dry rot in the root crops. Insects or other members of the soil fauna may, however, accentuate the damage already caused by the fungus at the base of the stem.

HANNA (A. D.). **The Description of a new Species of** *Euchalcidia* **(Hymenoptera, Chalcidinae).**—*Ann. Mag. nat. Hist.* (10) **13** no. 76 pp. 474–479, 3 figs. London, April 1934.

Both sexes are described of *Euchalcidia caryobori*, sp. n., which was found parasitising the late larval and early pupal stages of the Bruchid, *Pachymerus* (*Caryoborus*) *pallidus*, Ol., in Sudanese senna (*Cassia* sp.) [*cf. R.A.E.*, A **19** 392] in the London docks. Characters distinguishing the female from that of *E. nebulosa*, Boy., are given.

(429) Wt. P2821/3585 1700 6/34 S.E.R. Ltd. Gp. 353. [A]

WYNN-WILLIAMS (M.). **Some Insect and Fungoid Pests of *Carduus* and *Cnicus* Species.**—*Northw. Nat.* **9** no. 1 pp. 24–30, 4 refs. Arbroath, March 1934.

Notes are given on insects that occur in Britain only on thistles of the genera *Carduus* and *Cnicus* and on those that feed on other plants also. The most intensive damage to the achenes of species of *Carduus* is caused by the larvae of *Dasyneura gibsoni*, Felt, which may thus be considered to be distinctly beneficial to agriculture. The eggs are laid in the flower-heads.

ALLEN (T. C.), PINCKARD (J. A.) & RIKER (A. J.). **Frequent Association of *Phytomonas melophthora* with various Stages in the Life Cycle of the Apple Maggot, *Rhagoletis pomonella*.**—*Phytopathology* **24** no. 3 pp. 228–238, 1 fig., 7 refs. Lancaster, Pa, March 1934.

Phytomonas melophthora [*cf. R.A.E.*, A **20** 533] was isolated from all stages of *Rhagoletis pomonella*, Walsh, in Wisconsin and was found to be carried both internally and externally by the adult in quantities sufficient to account for its observed dissemination in that State. The bacteria were found in ovipositor punctures, larval burrows and exit holes in apples. They probably did not occur inside the eggs, but were found on about a third of 24 egg-shells examined. They were present both in and on the larvae. Of the puparia examined, 64 per cent. carried the bacterium externally, but none internally. It probably overwinters, therefore, on their surface.

WEIMER (J. L.). **Studies on Alfalfa Mosaic.**—*Phytopathology* **24** no. 3 pp. 239–247, 3 figs., 4 refs. Lancaster, Pa, March 1934.

Alfalfa mosaic [*cf. R.A.E.*, A **22** 219], the symptoms of which are described, appears to be widely distributed as a disease of lucerne in the United States. *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) transmitted it from diseased to healthy lucerne plants in 36·5 per cent. of tests. Negative results were obtained with a leafhopper, (?) *Empoasca fabae*, Harr., and a thrips, (?) *Frankliniella* (*Euthrips*) *occidentalis*, Perg.

POOS (F. W.) & WESTOVER (H. L.). **"Alfalfa Yellows."**—*Science* **79** no. 2049 p. 319. New York, 6th April 1934.

Factors affecting the control of *Empoasca fabae*, Harr., on lucerne by deferred mowing of the first crop [*cf. R.A.E.*, A **21** 665] in Washington State and Ohio proved to be complex and apparently to vary locally. Where this mowing has been deferred for 10 or more days, the more serious injury to the second crop has sometimes been avoided, but this result has not always been obtained. At an experiment farm in Washington there appears to be, each year, a continuous migration of the leafhopper to lucerne from mid-May to the end of June or later, after which special periods of migration occur as potatoes or other plants become less attractive. In favourable conditions of weather and food-plants, the insect can build up its populations to very large proportions within a comparatively short time, and the influence of these factors must be determined before any mowing schedule is adopted.

In a footnote, the authors state that it is preferable to refer to the injury caused by *E. fabae* as potato-leafhopper injury, since the term " yellows " suggests that a virus or bacterial disease is involved and also because various shades of pink and red as well as yellow are usually present.

HINDS (W. E.). **Some Achievements in Economic Entomology.**—*J. econ. Ent.* **27** no. 1 pp. 37–52. Geneva, N.Y., February 1934.

The author estimates the annual economic losses due to Arthropods in North America at over £500,000,000 [at par]. As an index of the progress made in their control, he estimates that the literature dealing with systematic entomology in that Continent amounts to about 10,000 papers to date; that dealing with economic entomology comprised over 12,000 at the end of 1904, and the Index of Economic Entomology from 1905 to 1929 contains more than 150,000 references. He then gives figures relating to insect collections, the teaching of entomology, the work of the State Experiment Stations and the Federal Bureau of Entomology, and the organisation of entomological research in Canada. He further discusses the insect pest surveys that have now been carried on in the United States and in Canada [*cf. R.A.E.*, A **22** 188] for about 12 years, the development of the Extension Service, progress in the use of insecticides, campaigns against various injurious insects, and outstanding work in the biological control of introduced pests, against which 80 per cent. of the control measures carried out in North America are directed.

DELONG (D. M.). **What shall be the Objective in the Training of an Entomologist.**—*J. econ. Ent.* **27** no. 1 pp. 53–58, 1 fig. Geneva, N.Y., February 1934.

The author outlines a scheme for training students in entomology that he considers better adapted than that at present current in the United States to the development of the power of original research. The first phase of the suggested scheme provides for a scientific grounding and training in technical research, the second for the evaluation and presentation of data and the third for professional and other human contacts. The interrelations between the various subjects to be studied are shown in a chart. The student should be made familiar with the enormous volume of literature pertaining to his special study, taught where to look for information, and enabled to interpret, evaluate, organise and use it in an intelligent manner as a working basis for research.

POOS (F. W.) & WHEELER (N. H.). **On the Hereditary Ability of certain Insects to transmit Diseases and to cause Diseaselike Injuries to Plants.**—*J. econ. Ent.* **27** no. 1 pp. 58–69, 7 figs., 22 refs. Geneva, N.Y., February 1934.

There is only one recorded instance [*R.A.E.*, A **22** 59] (which is noticed in a footnote) of the inheritance by an insect vector of the virus of a plant disease. Different degrees of ability to transmit a disease to plants or to cause a disease-like injury to them are, however, sometimes inherited [*cf.* **21** 486, etc.]. In studies carried out in Virginia with three generations of *Empoasca fabae*, Harr., the technique of which is described, no variation was found in the ability

of nymphs and adults to cause disease-like injury to seedling lucerne and clover. In similar experiments with *Myzus persicae*, Sulz., infective parents did not transmit to their offspring the virus of spinach-blight [*cf.* **21** 537], and the ability of the adults to infect healthy spinach plants was decreased by their removal for several hours from infected material.

PRICE (W. A.). **The Green June Beetle in Lawns.**—*J. econ. Ent.* **27** no. 1 pp. 69–72, 2 figs. Geneva, N.Y., February 1934.

Cotinis (*Allorrhina*) *nitida*, L. (green June beetle) has been causing serious injury to lawns in Kentucky during the past few years. The larvae make horizontal tunnels near the surface, which partly uproot the grass and render the soil porous and dry, and vertical ones as deep as 12–15 inches, the loose coarse earth excavated at night being piled in small mounds and adding to the injury of surviving plants [*cf. R.A.E.*, A **10** 164]. In all cases investigated by the author, the eggs have been laid in heaps of grass cuttings, so that infestation may be prevented by proper disposal of these at a sufficient distance from lawns. A barrier in the form of a wooden trough sunk in the ground [**10** 628] will prevent the larvae migrating from adjacent grass piles or other decaying vegetation. Infested lawns should be surrounded with these troughs and thoroughly soaked in the evening with water; in a rich loam soil, grubs began crawling out 20 minutes after watering with 15 U.S. gals. to the square yard. Pyrethrum extract (1 lb. to 4 U.S. gals. water) will bring them to the surface more quickly. They can then be collected with forceps or in some cases trapped in the troughs by flooding the lawn.

THOMPSON (B. G.). **The Green Trogositid reared from Walnuts.**—*J. econ. Ent.* **27** no. 1 p. 72. Geneva, N.Y., February 1934.

A larva of *Temnochila virescens*, F., which is known as a predator, was found in a walnut [*Juglans regia*] in Oregon. It was brought into the laboratory in December 1932 and pupated in the following June, after most of the nut had been consumed. The adult emerged in December 1933.

DIETZ (H. F.) & ZEISERT (E. E.). **Barium Fluosilicate (Dutox) in Blister Beetle Control.**—*J. econ. Ent.* **27** no. 1 pp. 73–79, 5 refs. Geneva, N.Y., February 1934.

Severe outbreaks of *Epicauta cinerea*, Forst. (*marginata*, F.) and *E. pennsylvanica*, DeG., occurred on potato, other vegetable crops and ornamental plants during 1931–33 in north-central Ohio. *E. vittata*, F., was entirely absent, and a local attack of *Pomphopoea aenea*, Say, in May 1931 was unimportant. In 1932, *E. marginata* first appeared in destructive numbers on 20th July, and both species were present for a time simultaneously; in 1933, it appeared on 11th July, followed by *E. pennsylvanica*.

Examination of the literature dealing with blister beetles showed that known methods of chemical control are unsatisfactory. From 16 series of laboratory tests, involving the use of more than 5,000 beetles, it was found that barium fluosilicate (Dutox) with flour, talc or clay (1 : 4) killed a uniformly high percentage in 24 hours. After 48 hours, the average percentage killed with clay or flour as

a carrier was 89, with lime 59, and with talc 96. Lime likewise reduced the efficiency of lead and calcium arsenate dusts, which even with talc (1 : 4) killed only 69 and 74 per cent. respectively. In the field, barium fluosilicate with flour or lime (1 : 4) or with flour and lime (1 : 3 : 1 or 1 : 2 : 2) applied at the rate of 25–35 lb. per acre in dry weather gave good control without injury to the plants, whereas spraying with 4 lb. lead arsenate to 100 U.S. gals. water or dusting with undiluted lead arsenate proved ineffective.

In the discussion that followed, the senior author stated that data from the three years' experiments showed that barium fluosilicate dusts control both the twelve-spotted and the striped cucumber beetles [*Diabrotica duodecimpunctata*, F., and *D. melanocephala*, F.] on cucumber. Against the flea-beetle [*Epitrix cucumeris*, Harr.] on potato, a dust of barium fluosilicate with flour or lime was inferior to the standard sprays [*cf. R.A.E.*, A **21** 511, 540], but with the addition of copper salts it was sometimes superior. Even in wet weather no noticeable scorching was observed, though other workers have reported it [*cf.* **22** 279]. Barium fluosilicate is one of the few fluorine compounds that is just soluble enough to be highly toxic to insects without injuring plants. Soaps have been regarded as incompatible with the more insoluble fluorine compounds because of the danger of their reacting and forming alkali fluorides injurious to plants.

Searls (E. M.). **The Effect of Alfalfa Cutting Schedules upon the Occurrence of the Potato Leafhopper (*Empoasca fabae* Harris) and Alfalfa Yellows in Wisconsin.**—*J. econ. Ent.* **27** no. 1 pp. 80–88, 1 fig., 1 ref. Geneva, N.Y., February 1934.

Detailed studies in Wisconsin in 1932 and 1933 confirmed the observation that lucerne suffered less from injury by *Empoasca fabae*, Harr., when the previous crop had been mown late [*cf. R.A.E.*, A **21** 665 ; **22** 274]. By mowing the first crop on 27th instead of 13th June and the second on 19th instead of 3rd August, infestation of the subsequent crops was markedly reduced. In plots in which the leafhoppers were controlled, the lucerne was more succulent and its unhampered growth tended to suppress weeds. Even where no other measures were used, the observance of a mowing schedule, synchronised with the vulnerable stages of *E. fabae*, produced a satisfactory growth.

Parker (J. R.), Shotwell (R. L.) & Morton (F. A.). **The Use of Oil in Grasshopper Baits.**—*J. econ. Ent.* **27** no. 1 pp. 89–96. Geneva, N.Y., February 1934.

In laboratory tests in North Dakota with hoppers of *Melanoplus differentialis*, Thos., *M. bivittatus*, Say, and *Camnula pellucida*, Scudd., baits of 4 lb. barium fluosilicate and 100 lb. bran in which 2 U.S. gals. vegetable or mineral oil was substituted for the usual 2 U.S. gals. molasses and 10 U.S. gals. water, when scattered at a rate equivalent to 20 lb. per acre, killed 77·4–84·3 per cent., as compared with 85·8 per cent. As a low-grade lubricating oil, having a viscosity of 30 S.A.E. rating, was almost as effective as other oils and much cheaper, it was used in subsequent comparative tests. In field plots infested with *M. mexicanus*, Sauss., and *M. bivittatus*, baits of 4 lb. sodium fluosilicate or 5 lb. white arsenic to 100 lb. bran were scattered at the rate of 10 lb. (dry weight) to the acre, and grasshoppers collected from the plots 3 hours after the bait was put out and each day thereafter for

4 days were kept for 3 days in screened cages containing green food to determine the mortality. On the first day, these baits killed 95·2 and 85·4 per cent. respectively when combined with the oil and 75·5 and 77·8 with molasses and water. On the fifth day, the corresponding percentages were 75·1, 60, 48·8 and 48·6. The mortality of the controls was 35·5–41·8 per cent.

In tests on a larger scale, oil baits were generally at least as effective as others. On extremely dry soil, however, where *C. pellucida* was massed in large numbers for oviposition, baits containing molasses and water were eaten more readily and produced distinctly greater kills than those containing oil (1½ U.S. gals. to 100 lb. bran). The use of a bait containing 2 U.S. gals. oil having a viscosity of 10 on 25 acres of flax infested with *M. mexicanus* gave excellent results.

A great advantage of oil baits is that they remain attractive for several days, whereas the ordinary ones often dry up so that any not eaten immediately are largely wasted. Thus it is not necessary to confine the application of an oil bait to the early morning prior to the main daily feeding period of the locusts. Moreover, the oil baits are easier to scatter and lighter to transport and, when prepared, can be stored without deterioration, whereas the ordinary baits ferment and cake after a few days.

RUGGLES (A. G.). **Three Years Work against the Grasshopper in Minnesota.**—*J. econ. Ent.* **27** no. 1 pp. 96–101, 4 maps. Geneva, N.Y., February 1934.

The development of grasshopper infestation in Minnesota is traced by means of maps from 1931 to 1934. A comparatively small area was involved in 1931. In 1932, when the infestation reached its maximum, control operations were brought into action, and a steady reduction followed in the succeeding years, during which grasshoppers received no natural setbacks. In 1931, a State grant was made and poison bran bait was distributed to farmers in infested areas. An egg survey at the end of 1931 indicated that a heavy infestation was in prospect for 1932 over 3,665,265 acres. A grant of £40,000 [at par] was made for the purchase and distribution of poison bait, 11,324 tons of which were distributed in 55 counties. At the end of the season it was estimated that over £2,400,000 worth of crops had been saved. By the autumn of 1932, the infested areas had been reduced to 528,828 acres. In 1933, 1,806 tons of bait were distributed, and no appreciable crop loss was reported. The autumn survey in 1933 showed less than 280,000 acres to be heavily infested with egg-pods, and the 1934 map shows the areas of infestation almost back to normal, with a few spots of relatively high infestation in the eastern part of the State.

ANDERSON (L. D.) & WALKER (H. G.). **The Life History and Control of the Potato Flea Beetle *Epitrix cucumeris* Harris on the eastern Shore of Virginia.**—*J. econ. Ent.* **27** no. 1 pp. 102–106. Geneva, N.Y., February 1934.

Studies on *Epitrix cucumeris*, Harr., have been carried out since 1932 in eastern Virginia, where its importance as a potato pest has been increasing. In one district, it caused a 25 per cent. reduction in crop yield in 1932 and 1933 as well as a reduction in quality. Beetles were kept in lamp-glasses covered at both ends with two thicknesses

of cheesecloth, through which they laid their eggs on cardboard disks covered with fine black mud and placed on moist soil. The disks were removed daily and placed in moist petri dishes; as the eggs hatched, small pieces of potato were supplied, which the larvae entered almost immediately. Later, the disks were removed and several teaspoonfuls of moist soil were added for pupation.

Overwintered adults were abundant in the field on 1st May 1933. Some of these were caged on 12th May, and eggs were taken until 2nd June, the maximum oviposition occurring on 21st May. The egg stage averaged 6 days, the larval 14, and the combined prepupal and pupal 12. These data accorded with the observed abundance of adults in the field about 22nd June, when their number was estimated at 2–2½ million per acre. It appeared that the potato plants most required protection early in the season until 25th May and again when the first-brood adults appeared after 20th June.

About 30 different insecticide combinations were tested, 6 applications of each being made at the rate of 100 U.S. gals. spray or 30–50 lb. dust to the acre with a compressed hand sprayer or a rotary hand duster. The best yield was obtained from plots dusted with lead arsenate and lime (1 : 1), calcium arsenate and lime being less effective. Sprays containing calcium arsenate in Bordeaux mixture (generally 4 lb. in 100 U.S. gals.) were also effective; the addition of nicotine sulphate (1 : 400) gave a slight increase in yield, but not enough to justify the increased cost. The addition of zinc sulphate to arsenical dusts or sprays generally gave a slight increase in yield. Paris green, barium fluosilicate and sodium aluminium fluoride (synthetic cryolite) scorched the plants, especially when applied during wet weather. More than 90 per cent. of caged beetles were killed by a derris dust containing 0·5 per cent. rotenone or a derris extract containing 5 per cent. diluted 1 : 400, but these did not give permanent protection in the field, as the beetles migrated from adjacent untreated plots.

The degree of negative correlation observed between yield and flea-beetle injury to the leaves for 20 treatments indicates that increases in yield were largely due to flea-beetle control. In some cases however, spray injury reduced the benefits derived.

MacLeod (G. F.) & Butcher (F. G.). **Studies of Milliped and Gnat Injuries to Potato Tubers.**—*J. econ. Ent.* **27** no. 1 pp. 106–108. Geneva, N.Y., February 1934.

Experiments designed to reduce injury caused to potato tubers in western New York by the millepede, *Diploiulus londinensis coeruleocinctus*, Wood, and larvae of *Sciara* sp. were conducted principally with sulphur at rates of 150–600 lb., naphthalene at 300–600 lb. or tobacco dust at 400–500 lb. to the acre, applied to the soil either by hand or with a grain drill and then worked in with a harrow before planting potatoes. None of the materials gave satisfactory control, but under certain conditions sulphur appeared materially to reduce injury to potato tubers provided that the hydrogen-ion concentration of the soil was reduced below pH 5 [*cf. R.A.E.*, A **21** 686, etc.].

Maughan (F. B.). **Further Studies on the Control of the Onion Thrips.**—*J. econ. Ent.* **27** no. 1 pp. 109–112. Geneva, N.Y., February 1934.

In further work against *Thrips tabaci*, Lind., on onion in New York State [*cf. R.A.E.*, A **21** 241], 5 applications were made between 1st

July and 5th August 1933 of a 4 per cent. nicotine dust or of crude chipped naphthalene, either alone or combined with alcoholic extract of pyrethrum and talc powder (8 : 5 : 7) or with hydrated lime (2 : 3). The naphthalene in the dusts was crushed and sifted through a fine screen, mixed with the carrier and allowed to stand in an air-tight container for 24 hours. The pyrethrum was added just before application. The naphthalene dusts were applied at the rate of 200 lb. per acre early in the morning when the plants were wet with dew, the nicotine (75 lb.) during the day at 75°F. or higher, and the undiluted naphthalene (300 lb.) in the afternoon at about 80°F. The dusts were applied with a hand and a power duster, and the crude naphthalene was applied by hand directly along the rows or broadcast over a number of rows at a time. The number of thrips surviving on 25 selected plants in each plot was recorded, and the onions from a determined area in each of the plots were weighed. From several tests, the average increase of yield in bushels per acre (which was definitely correlated with decrease of infestation) produced by the different treatments was approximately as follows : naphthalene broadcast, 55 ; naphthalene on the row, 62 ; nicotine dust, 46 ; naphthalene-lime, 71 ; naphthalene-pyrethrum, 75. The cost of the nicotine renders its use impracticable. Apart from the initial cost of dusting machinery, the total cost of applying naphthalene-lime dust is much lower than that of applying crude chipped naphthalene by hand, but the use of machinery when the thrips are most abundant involves some injury to the plants.

Menusan, jr. (H.) & Dickison (W.). **Potato Spraying and Dusting Experiments on Long Island.**—*J. econ. Ent.* **27** no. 1 pp. 112–117, 5 refs. Geneva, N.Y., February 1934.

Potatoes in Long Island during the seasons 1930–33 received several applications (4–6 on one variety and 5–8 on another) at weekly or ten-day intervals from the first week in June of a Bordeaux mixture spray (generally 4 : 4 : 50) applied at the rate of 125 U.S. gals. to the acre with a horse-drawn power machine, or of a dust of copper sulphate and lime (20 : 80) applied at the rate of 35 lb. to the acre by a traction or power machine. The average yield of tubers from the treated plots, however, was less (by 16·9 bushels per acre from the dusted and 9·1 from the sprayed plots) than from the untreated ones. Reduction of the hydrated lime concentration in the spray to 4 : 1 : 50 had no particular effect on the yield. On the other hand, 3 applications of spray made relatively late in the season (July), when the plants had reached their maximum growth and leafhoppers [*Empoasca fabae*, Harr.] were more abundant, resulted in an increase of 10·9 bushels per acre, whereas 3 early (June) applications gave a decrease of 23·3 bushels.

Much of the reduction in yield obtained in these experiments is attributed to mechanical injury from the spraying and dusting machines.

Wolfenbarger (D. O.). **Some Effects on Potato Flea-beetle** (*Epitrix cucumeris*, **Harris**) **Injuries and Yields by Spraying.**—*J. econ. Ent.* **27** no. 1 pp. 118–120, 1 ref. Geneva, N.Y., February 1934.

In three years' work in western New York, sprays of Bordeaux mixture (5 : 7 : 50) alone or in various combinations failed to control

Epitrix cucumeris, Harr., on potato. Ten sprays were applied in 1931, 8 in 1932 and 6 in 1933. Adult feeding on the leaflets was reduced, but not larval feeding on the tubers. Bordeaux mixture with calcium arsenate (2 lb. in 50 U.S. gals.) reduced the average number of holes per leaflet from 39·2 to 21·8 and of feeding scars per tuber from 14·9 to 10·8, and increased the yield from 308·7 to 412·7 bushels per acre. With 2 lb. lead arsenate the yield was 407·5, with 2 lb. barium fluosilicate 320·6 and with Bordeaux alone 384·2 bushels per acre. The control rows were sprayed once in 1931 and twice in 1932 and 1933 with 2 lb. calcium arsenate in 50 U.S. gals. water against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say].

Holbert (J. R.), Flint (W. P.) & Bigger (J. H.). **Chinch Bug Resistance in Corn—an inherited Character.**—*J. econ. Ent.* **27** no. 1 pp. 121–124, 3 figs. Geneva, N.Y., February 1934.

Data accumulated in central Illinois indicate that some inbred varieties of maize carry dominant factors producing increased resistance and susceptibility, respectively, to the chinch bug [*Blissus leucopterus*, Say]. They also suggest that strains may be developed that will combine resistance to this bug with other desirable characters.

Symposium on the Spray Residue Problem.—*J. econ. Ent.* **27** no. 1 pp. 124–180, 14 refs. Geneva, N.Y., February 1934.

The following papers were read at Harvard University on 29th December 1933 under the chairmanship of P. J. Parrot.

In The current Season's Experience in enforcing Spray Residue Tolerances (pp. 125–133), W. B. White, representing the United States Food and Drug Administration, deals mainly with the residue problem as affecting public health, including the experience gained in 1933 in controlling interstate shipments of sprayed fruit and vegetables. In view of the stabilisation of spray schedules and the results of extensive washing experiments, he considers that there should be little difficulty in meeting the lead tolerance of 0·019 grain per lb. fruit fixed for 1934. He states that the residues of fluorine compounds are more difficult to remove from apples than those of lead arsenate. Care is also needed in the exploitation of new, potentially dangerous insecticides such as mercury and selenium.

R. L. Webster, in The Status of Codling Moth Control with Insecticides (pp. 134–139), emphasises the increasing difficulty of controlling *Cydia* (*Carpocapsa*) *pomonella*, L., as experienced in Washington State [*R.A.E.*, A **22** 217]. The use of nicotine-oil combinations in late cover sprays resulted in an even heavier lead deposit than that found on apples sprayed throughout the season with lead arsenate [*cf.* **22** 216].

E. J. Newcomer reports on The Status of Codling Moth Control in the Pacific Northwest (pp. 139–141) [*cf.* **22** 256], where 6 cover sprays have not always proved adequate. In some districts it would probably be preferable to abandon cultivation of apples rather than to attempt to control *C. pomonella*. Improved methods of cleaning brought 97 per cent. of the fruit washed up to 1st December under the 1933 lead tolerance of 0·02 gr. per lb. and 70 per cent. under the recommended figure of 0·014 gr. Good results were invariably obtained

by using sodium fluoaluminate (cryolite) for second-brood sprays with fish oil, mineral oil or soap, though fluorine residues were difficult to remove. Poor results were obtained with calcium or manganese arsenate, and injury by the latter was sometimes severe.

A brief report is given by W. P. Flint on Codling Moth Control by the Use of Insecticides in Michigan, Ohio, Indiana and Illinois (pp. 141–143), the general results for 1933 showing that lead arsenate is superior to any other material, though lead arsenate alone was not always superior to calcium arsenate. In Ohio and Illinois, lead arsenate alone failed to give satisfactory control of very heavy infestations, but its effectiveness was increased by the addition of certain oil sprays. In Illinois only, the addition of certain oils to the lead arsenate sprays for late first-brood and second-brood larvae reduced the percentage of infested fruit by more than half over a period of three years as compared with lead arsenate alone.

S. W. Harman, on The Status of the Codling Moth in the North-eastern States (pp. 143–145), reports that *C. pomonella* has been steadily increasing there in the last 10 years. Areas where excessive losses occur are fairly well defined ; they are most serious in southern New Jersey, but diminish towards the north and east. In Maine, injury rarely exceeds 1 per cent. of the total crop. The apple maggot [*Rhagoletis pomonella*, Walsh], which is generally widely distributed where *C. pomonella* is scarce, requires the application of July sprays that would not be needed for the latter. Calcium arsenate, although satisfactory from the residue standpoint, was noticeably less efficient than lead arsenate against serious infestations. The practice of dry cleaning and washing the fruit is becoming more general where extensive summer spraying is practised.

W. S. Hough reports on The Status of the Codling Moth Control in the Shenandoah-Cumberland Fruit Region (p. 145), where the outbreak in 1933 was the worst experienced for 13 years. Experience of several years in Virginia shows that lead arsenate cannot be applied after 10th–15th June without risk of exceeding the lead tolerance for 1934. Unless the fruit is washed, calcium arsenate and Bordeaux mixture should be used after mid-June, or else the trees should be left unsprayed.

W. A. Ross, reviewing The Codling Moth Situation in Ontario (pp. 146–147), points out that the moth is more easily controlled in the northern sections (where a calyx spray is sufficient) and at altitudes over 350 ft. and also beside the Great Lakes. In certain areas where three sprays are sometimes inadequate, growers are confronted with the arsenical residue problem, but it has not been decided whether washing outfits would be justified or whether it is better to accept occasional loss of the crop.

The following is taken from the summary and conclusions of T. J. Headlee in his paper To what Extent may Organic Insecticides be used as Substitutes for Arsenicals ? (pp. 148–156, 8 refs.) : Enough work has been done on nicotine to show that certain compounds of it, such as the tannate, can be more effective against *C. pomonella* than arsenicals [*R.A.E.*, A **18** 386, etc.]. Although pyrethrum and derris can be used for destroying chewing insects, they remain toxic for too short a time. Even so they offer the best available substitute for arsenicals on certain vegetable plants. Oils applied during the growing season are likely to cause injury to plants unless so inactive as to be useless as insecticides. In the discussion that followed, the

author stated that sprays of nicotine tannate combined with bentonite sulphur would be recommended for apple protection equally with lead arsenate in New Jersey, a special spraying schedule being prepared, in addition to the general schedule, for orchards where a severe infestation of *C. pomonella* is expected. Bentonite sulphur is a combination of bentonite and sulphur at the melting point of the latter. Its adhesive properties are much greater than those of the two components. Cover sprays should be directed chiefly against the first brood, with not more than two applications against the second. As the larvae overwinter only on the trees, scraping the bark and applying pine oil to the cracks, scars and crevices are recommended where infestation is very severe. It was pointed out by P. J. Chapman that nicotine preparations have proved ineffective against *R. pomonella* in New York State.

H. C. Huckett, in a review of The Situation in the Vegetable Industry with Respect to the Use of Arsenicals and Arsenical Substitutes (pp. 156–161), refers to the significant increase during the last decade in the number of shipments of vegetables in inter-State commerce held up for inspection owing to excessive arsenical residues. The supposition that the outer leaves of cabbages, etc., are normally removed and the danger thus eliminated has been recently disproved, and the tendency to dust rather than spray has resulted in increased residues on certain parts of the plants. Both pyrethrum and derris were used on cauliflowers in 1933 in Long Island in view of excessive arsenical residues in the previous season. Dusts of 0·5–1 per cent. rotenone were effective in protecting the crop. About 150 tons of prepared derris dusts were sold in 1933 in Long Island as substitutes for calcium and lead arsenates, although their price was about double, and growers intend to continue their use on cauliflower. Derris dusts have also been used successfully for the control of the Mexican bean beetle [*Epilachna corrupta*, Muls.].

R. H. Robinson, discussing the Latest Developments in washing Apples (pp. 162–167) [*cf.* **22** 183], states that the heaviest residues may be removed by fortifying the solvent with kerosene or light petroleum oil. These oils (in a 1 per cent. kaolin emulsion) were also effectively used, as an alternative to plain water or sodium silicate, in a preliminary dipping at 80–100°F. in a tank connected with the washing machine. Investigations carried on by the United States Bureaux of Plant Industry and of Chemistry and Soils indicate that when fluorine compounds are used in only 2–3 cover sprays, either hydrochloric acid or sodium silicate will clean the fruit effectively below the 0·01 grain tolerance, but when they are used in combination with either mineral oil or fish oil the residue is not removed satisfactorily by any treatment.

H. C. McLean and A. L. Weber, in discussing the Influence of Spray Schedule and other Factors on Spray Residue Removal (pp. 168–180, 6 refs.), allude to recent developments in the removal of spray residues from apples in New Jersey [**20** 140 ; **21** 475]. In later studies, casein spreaders used with oil-lead arsenate sprays greatly increased the difficulty of removing residues. Contrary to expectation, the presence of honey-dew secreted by Aphids facilitated washing. The most effective alkaline treatment for lead residues was a mixture containing 10 per cent. B.W. silicate and 1 per cent. Vatsol maintained at 115°F. for 2½ minutes. Wetting agents increased the efficiency of alkaline silicates in removing fluorine residues. When

oil is not used with lead arsenate in addition to casein or colloidal protein type spreader, all varieties of apple may be sprayed up to the time of harvest and the residues removed with cold hydrochloric acid. Early ripening varieties sprayed five times (27–67 days after petal-fall) with oil-lead arsenate and a non-casein spreader may be satisfactorily washed in hydrochloric acid with the addition of a wetting agent. The acid alone will successfully wash early varieties where oil and lead arsenate are applied not later than 57 days after petal-fall, followed 10 days later by lead arsenate and non-casein spreader without oil [but *cf.* **22** 299], and later ones if sprays of 3 U.S. quarts medium summer oil and 2 lb. lead arsenate to 100 U.S. gals. are applied not latter than 57 days after petal-fall ; where similar oil-lead arsenate sprays 67 and 77 days after petal-fall are applied, the addition of a special wetting agent will be essential. At atmospheric temperatures, the fruit should probably remain in contact with the wash solution for at least 45 seconds or be dipped for 1½ minutes in a vat containing the acid and the wetting agent before passage through the commercial washer. The use of any later sprays of oil and lead arsenate in the concentrations stated may necessitate heating the washing solution, but the application of lead arsenate and non-casein spreaders after the 67-day spray does not affect the recommendations. The addition of an anti-foam agent will be necessary where special wetting agents are used in the spray or flood type of commercial washers. Oil-lead arsenate sprays may be applied 27 and 37 days after petal-fall followed by oil-nicotine sprays without resulting in spray residues in excess of the Federal tolerance on autumn or winter varieties of apples at harvest [but *cf.* above, p. 281].

BARE (C. O.). *Isotomurus palustris* (**Müll.**), **a Springtail injurious to Celery.**—*J. econ. Ent.* **27** no. 1 p. 180. Geneva, N.Y., February 1934.

Serious injury was caused by *Isotomurus palustris*, Müll., to the lower surface of the leaves of small celery plants in Florida in August 1931. About one-third of the plants died, and others were badly damaged. A lowering of the water-table beneath the beds to cause the soil to dry up and a heavy application of nicotine dust gave almost immediate relief, and the remaining celery plants soon recovered.

PIERCE (W. D.). **Some Thoughts on the Interpretation of Experimental Data.**—*J. econ. Ent.* **27** no. 1 pp. 185–190. Geneva, N.Y., February 1934.

The author criticises the practice of expressing data on the relation between temperature and development of insects by means of a hyperbola without regard to the fact that development is retarded or inhibited by high as well as by low temperatures and is affected by humidity and pressure. He also considers that the attempt to correlate data on development with saturation deficiency is misleading. He illustrates by reference to a paper recently noticed [*R.A.E.*, A **21** 609] the failure of the median lethal dosage to give a reliable indication of that required to kill 100 per cent.

FELT (E. P.). **Shade Tree Insects in 1933.**—*J. econ. Ent.* **27** no. 1 pp. 195–200. Geneva, N.Y., February 1934.

Severe injury was caused to shade trees in the north-eastern United States in 1933 by the following leaf-eating insects: *Alsophila pometaria*, Harr. (fall cankerworm), of which an unprecedented outbreak occurred in Connecticut and New York [*R.A.E.*, A **22** 26]; *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.), normally a pest only in cities and villages, which invaded woodlands for the first time, stripping elms in swamps as completely as those on highways; *Popillia japonica*, Newm., which continued to be a serious pest in the Philadelphia area; *Plagiodera versicolora*, Laich., on willows [*cf.* **21** 316]; *Porthetria dispar*, L., which has been increasing in south-eastern Massachusetts and has spread in Pennsylvania beyond the barrier zone; and *Coleophora laricella*, Hb. (larch case-bearer), which has remained abundant over large areas, including extensive forest sections. The galls of the Cynipid, *Andricus coronus*, Beutm., were so abundant on pin oak [*Quercus palustris*] at one locality in New York State that very little foliage remained uninfested. The steady increase in the ravages of these and other insects suggests that before long a comprehensive protective programme will have to be adopted for shade trees.

Injury to pine tips by *Pissodes strobi*, Peck (white-pine weevil) has been temporarily eclipsed by more recent introductions or an unusual abundance of species previously attracting little notice. *Rhyacionia buoliana*, Schiff., which has been exceedingly destructive in recent plantings of red and Scots pine [*Pinus resinosa* and *P. sylvestris*], practically destroying trees over considerable areas, was effectively controlled by a combined spray of nicotine, oil and lead arsenate, applied during the flight period. *R. frustrana*, Comst., and *R. rigidana*, Fern., have become unusually numerous in some localities. On white pine [*P. strobus*], *Eucosma gloriola*, Heinr. (white-pine shoot moth) has become more abundant in southern New England [*cf.* **20** 86, 225], is well established in south-eastern New York and has been reported from the Adirondacks. The larvae tunnel almost exclusively in the lateral shoots, where 20 or more occur together on trees possibly 30 ft. high, causing the last 6–8 inches to die back. Occasionally they destroy a weak leader. They leave the shoots before any appreciable discoloration occurs and overwinter in the soil. An outbreak of *Pityophthorus pulicarius*, Zimm. [**21** 659] on Austrian pine [*Pinus nigra* var. *austriaca*] was probably promoted by reduced vitality of the trees due to a long series of dry seasons.

Zeuzera pyrina, L., which was abundant on elms in Nantucket Island in 1932 [**21** 231], was effectively controlled by treating inhabited galleries with a commercial borer paste. *Agrilus bilineatus*, Web., which remains a serious pest of both ornamental and forest trees in Long Island, Pennsylvania and Delaware [**21** 75, 657], was checked by spraying with lead arsenate at the end of May or beginning of June. Against *Scolytus quadrispinosus*, Say (hickory bark-beetle), cutting out infested trees, combined with measures to stimulate vigorous growth [*cf.* **19** 486] and spraying with lead arsenate at the feeding period of the beetles, gives very satisfactory control. *Xylotrechus quadrimaculatus*, Hald., was abundant on beech in Connecticut, Long Island and Massachusetts [**21** 656]; *Cyllene robiniae*, Forst. (locust borer) was unusually prevalent [on *Robinia pseudacacia* (*cf.* **22** 304)] in New York; and *Melanophila fulvoguttata*, Harr., killed

hemlocks [*Tsuga*] in Connecticut and New York. On beech, *Cryptococcus fagi*, Bär., is established in Maine in association with *Nectria coccinea* [*cf.* **21** 167] and has been found in Massachusetts [**20** 300].

Thomas (C. A.). **Further Observations on Mushroom Insects.**—*J. econ. Ent.* **27** no. 1 pp. 200–208. Geneva, N.Y., February 1934.

In further studies in Pennsylvania [*cf. R.A.E.*, A **20** 301], canvas or heavy building paper was placed over small test piles of manure two days before its use in mushroom houses. This caused the manure to heat to the surface and drove the insects up under the cover ; large numbers were then killed by rolling this back, applying small quantities of calcium cyanide, a nicotine dust or carbon bisulphide and immediately replacing it to retain the gases. In tests on a small scale, the mycelium ran well in manure so treated. Heating the beds to a subsurface temperature of 125°F. by raising them a few inches and using fans in the aisles will drive insects, especially springtails (Collembola) to the surface. At 135–140°F., practically all springtails are killed by heat alone, but it must generally be supplemented by sulphur [*cf. loc. cit.*] or fumigation with hydrocyanic acid gas, ½ lb. calcium cyanide to 1,000 cu. ft. being sufficient against springtails actually exposed to the gas. Springtails frequently attack the spawn pieces, to which they are attracted by the odour and moisture of the mycelium. They feed on the outside of the grains of the grain spawn and may carry moulds into it, but rarely actually bore into it. Their presence may be detected by letting a light (to which they will immediately crawl) shine through a piece of paper placed against the uncovered spawn piece. If the house is then warmed and the surface of the manure sprinkled with water, they will come to the surface in large numbers and may be controlled by dusting or spraying with nicotine. Pyrethrum powders, powdered derris and rotenone dusts are only partly or slowly effective. Springtails on the aisles may be rapidly killed by broadcasting naphthalene, which should not be allowed to fall on the beds and should be removed from the house after two hours. The most destructive species in 1933 was *Proisotoma* sp. near *thermophila*, Axels., and *Hypogastrura* (*Achorutes*) *armata*, Nic., and *Lepidocyrtus cyaneus*, Tull., were also common. *L. lanuginosus*, Gmel., which has caused some injury in Pennsylvania and Ohio by making holes in mushroom caps and stems, is negatively phototropic to artificial light.

Injury has also been caused to spawn pieces by the Phorid, *Megaselia* (*Aphiochaeta*) *agarici*, Lint., within a few days after planting when the larvae move in from adjacent manure, and by Mycetophilids, *Sciara* spp. If the mycelium can become established, it continues to grow unchecked by their feeding ; otherwise its growth must be stimulated by keeping the temperature at about 70–75°F., which also hastens pupation. The pupal stage of the Phorid lasts two weeks, during which the mycelium can become well established before any new larvae enter the manure. Nicotine or pyrethrum dusts or sprays applied to the bed surface may kill many of these larvae, which sometimes appear on the casing soil after the bed is watered and even pupate there. Occasional injury to growing mushrooms by Phorid larvae boring in the stems and caps may be controlled by raising the temperature to cause the larvae to go down into the beds to pupate, as pupation seldom occurs within the mushroom. Higher temperatures, however, favour the growth of

mushroom diseases. Close picking and destruction of infested mushrooms also helps to control the Phorid. As little as ¼ oz. calcium cyanide per 1,000 cu. ft. killed many of the adult flies, but the temperature must be raised for several hours before and during fumigation to bring the flies out of the beds and also to prevent condensation of moisture on the mushrooms and consequent scorching. Frequent repetition of this treatment is not recommended, and it can be supplemented by pyrethrum dusting, though this is not so effective as it is against *Sciara*. Fumigants of high nicotine content will kill many of the Phorids, though some recover, and spraying liquid nicotine fumigants on hot pipes has sometimes proved effective.

The pupal stage of *Sciara* lasts a week. Dusting with pyrethrum as soon as the first flies are seen seems to be more effective than the use of hydrocyanic acid gas ; the dust remains toxic 72 hours after application. Nicotine dusts may be of value, but rotenone dusts appear to be much slower in action and ineffective against insects in the manure. The Mycetophilid larvae also chew the manure into damp, broken-down granular material and destroy mycelium growing in it, but if not too much injured it may eventually produce a good crop. They usually raise the pH of the manure above 7, perhaps owing to their alkaline faeces. They begin to mine in the stems and caps later in autumn than the Phorids, and may continue throughout the winter. They also appear occasionally on the surface of the soil after watering, where they may be controlled by pyrethrum or nicotine dusts or sprays. They are little affected by hydrated lime except when it is applied quite dry. As they rarely occur on the soil surface except when it is moist, lime is thus useless, and toxic dusts and sprays that do not depend on their drying properties are more effective.

Considerable damage was caused in the autumn by Cecidomyiid larvae that feed at the base of the mushrooms, cutting out the tissues and destroying the mycelial roots. They also burrow under the surface of the upper stem and the under part of the cap and into the gills. They do not burrow up through the stems and caps like *Sciara* and *Megaselia*. They also appear at times in large numbers on the bed surface after watering. Pyrethrum dusts and sprays are effective when actually coming in contact with them, but as insecticides do not affect them under the stems or in the caps, the mushrooms must be close picked before application. The adults are easily killed, but appear only in small numbers.

Other insects sometimes found in mushroom houses are *Forcipomyia cilipes*, Coq., a Scatopsid, *Rhegmoclema* sp. probably *atrata*, Say, a Mycetophagid, *Litargus* sp., and *Aphodius fimetarius*, L. Various mites, which can be killed with hydrocyanic acid gas or burning sulphur if the manure is heated sufficiently to drive them to the surface, may enter the spawn pieces and eat out the mycelium, or even bore into and destroy the grains of grain spawn, the chief species involved in this type of injury being *Rhizoglyphus phylloxerae*, Riley. These mites do not leave the piece if the bed surface is moistened, nor will warming the house force them into a non-feeding stage. If they destroy the spawn piece before the mycelium has established itself in the manure, replanting may be necessary ; the new pieces should be planted midway between the old ones rather than in or near them, as the mites seldom migrate from them. *R. phylloxerae*, *Chortoglyphus* (*Histiostoma*) *gracilipes*, Banks, and *Tyroglyphus lintneri*, Osb., occasionally attack growing mushrooms, and few insecticides will affect them without injuring

the mushrooms. Gamasids, which sometimes appear in large numbers on the beds while they are in heat but soon disappear, are predacious on other mites and springtails. A heavy infestation of mites was controlled by first picking all marketable mushrooms, then removing and destroying as many infested ones as possible and finally cleaning the soil surface with a furniture vacuum cleaner.

McIntyre (H. L.), Britton (W. E.) & Allen (R. H.). **Report of the Committee on European Pine Shoot Moth Control appointed by the Chairman at Hearing in New Haven.**—*J. econ. Ent.* **27** no. 1 pp. 208–209. Geneva, N.Y., February 1934.

A brief account is given of the bionomics of *Rhyacionia buoliana*, Schiff., which has caused severe injury to forest plantings of red and Scots pines [*Pinus resinosa* and *P. sylvestris*] in south-western Connecticut, south-eastern and western New York and southern Ontario, and is believed to be generally distributed throughout the north-eastern United States [*cf. R.A.E.*, A **19** 652; **20** 650; **21** 98]. Recommendations are made for organised control. The measures consist of clipping and burning infested tips, usually between September and the following June; spraying according to recommended formulae between the middle of June and the middle of July; and the destruction of heavily infested and dying trees. Systematic inspections have shown that severely infested areas in forest plantations are generally of limited extent, and experiments conducted by several States encourage the belief that effective control is feasible.

Langford (G. S.). **Winter Survival of the Potato Tuber Moth** *Phthorimaea operculella* **Zell.**—*J. econ. Ent.* **27** no. 1 pp. 210–213, 2 refs. Geneva, N.Y., February 1934.

In experiments in Maryland, all stages of *Phthorimaea operculella*, Zell. (potato tuber moth) except the egg were killed by exposure to 2°F. for 24 hours. Eggs laid in the insectary at different dates during the winter of 1931–32 hatched in 55–85 days, and it is possible that the winter is sometimes passed under suitable storage conditions in this stage, though eggs kept for 4 months at 35–40°F. failed to hatch. Partly grown larvae placed under observation in November or December died before 1st April [*cf. R.A.E.*, A **14** 471; **16** 20]. Larvae exposed for 15–20 days to temperatures fluctuating between 15 and 50°F. and then transferred to room temperature completed their development, as did newly hatched ones kept at the same temperatures without food for 13 days. Of full-grown larvae kept under the sheltered conditions of the insectary from late November, December or early January, 33 per cent. produced adults, most of which were alive in late April. Although the pupae can withstand relatively low temperatures, so many transform to adults during warm intervals that very few survive till spring. Individual moths that lived 30–40 days during December–February laid eggs that hatched, but the adults probably cannot live through the dormant season. Adults emerging during January have laid eggs that hatched in April, but it is not likely that larvae could reach food at this season. Some full-grown larvae and pupae survived exposure to 35–40°F. for 5 months; 16 per cent. of 25 larvae and 1·6 per cent. of 125 pupae reached the adult stage. Adults emerged from 60–70 per cent. of pupae kept at 40–48°F. for 60 days.

It is concluded that in Maryland *P. operculella* would only be able to survive the winter under field conditions in sheltered situations; in sites exposed to the sun, where the temperature is often higher by 25°F. or more, the moths would emerge early in winter.

BURDETTE (R. C.). **Results of two Years' Work with an Attractive Spray for Corn Ear Worm Moth** (*Heliothis obsoleta* **Fab.**).—*J. econ. Ent.* **27** no. 1 pp. 213–217. Geneva, N.Y., February 1934.

Of various poisoned bait sprays tested against *Heliothis obsoleta*, F., in New Jersey, the most effective consisted of 8 lb. of an invert sugar syrup (syrline) [*R.A.E.*, A **20** 422] and 1½-2 lb. tartar emetic [*cf.* **21** 245] to 50 U.S. gals. water. Moths that had fed on this spray did not deposit eggs in the cages. In the field, however, though large numbers of moths were killed, they continued to oviposit after having fed, until the poison took effect. In 1933, a band 12 ft. wide round each of several small blocks of maize was sprayed regularly during the summer about sunset, when the moths fly back into the maize; 85–90 per cent. fed on the spray, but subsequent infestation by the larvae was not appreciably reduced. A very small percentage of moths surviving would lay enough eggs to infest the field. This treatment would, however, offer many advantages if a more rapidly acting poison could be discovered.

PARROTT (P. J.). **Experiences with the Codling Moth in New York during 1933.**—*J. econ. Ent.* **27** no. 1 pp. 218–222. Geneva, N.Y., February 1934.

The effect on *Cydia* (*Carpocapsa*) *pomonella*, L., of abnormally hot weather in June and July, following two mild winters and the hot, dry summer of 1932, was probably the chief cause of the unprecedented injury to apples in New York in 1933. The percentage of parasitism by *Ascogaster carpocapsae*, Vier., was 14·56 in 1931, 8·07 in 1932 and 6·45 in 1933. *Trichogramma minutum*, Riley, also appeared to be less effective than during previous years. The omission of important spray applications also increased infestation.

The damage varied greatly according to the locality. In Niagara County, where it was in general particularly severe, a susceptible variety that had received 5 cover sprays of 3 or 5 lb. lead arsenate to 100 U.S. gals. showed 35–75 and 10 per cent. injury, respectively; in poorly sprayed or untreated orchards, the crop was a total loss. In orchards on Lake Ontario that had received 3 cover sprays of 3 lb. lead arsenate to 100 U.S. gals., injury did not exceed 10–20 per cent.

Experiments with 12 of the most promising insecticides showed lead arsenate alone or with oil to be the most effective. If climatic conditions revert to normal, the difficulties associated with spray residue removal will probably become less acute.

HARMAN (S. W.). **Codling Moth Control Experiments during 1933.**—*J. econ. Ent.* **27** no. 1 pp. 222–225. Geneva, N.Y., February 1934.

Experiments were carried out in 1933 in 3 apple orchards in western New York with five cover sprays of various materials against *Cydia* (*Carpocapsa*) *pomonella*, L., which was so abundant that 100 per cent. of the fruit was infested when cover sprays were omitted. The most effective was lead arsenate alone (6 lb. in 100 U.S. gals.), which gave

89 per cent. uninjured fruit. Of fruit treated with 3 lb. lead arsenate in the first spray and 2 lb. lead arsenate and 3 U.S. qts. summer oil in the other four, 80 per cent. was uninjured, but it was deficient in colour and showed traces of russeting in the calyx cavity. Manganese arsenate (4 lb.) with 1 U.S. qt. summer oil was about as effective as 3 lb. lead arsenate, but the trees lost many leaves late in the season and those remaining showed marginal scorching. On one highly susceptible variety on which lead arsenate, manganese arsenate and nicotine-oil were all fairly effective, magnesium arsenate, calcium arsenate, copper arsenite, zinc arsenate, cuprous cyanide, cryolite (natural and synthetic), nicotine tannate, anabasine-oil and derris extract all gave high percentages of infested fruit. Calcium arsenate with Bordeaux mixture caused considerable yellowing and dropping of foliage.

All the arsenicals left a residue in excess of the permitted tolerance. Washing for 25–30 seconds in a 1 per cent. hydrochloric acid solution at 59°F. within two weeks after picking effectively reduced it, except from manganese, magnesium and lead arsenates. Fruit receiving not more than 4 cover sprays of 3 lb. lead arsenate without oil applied not later than the first week in August was, however, effectively cleaned.

STEARNS (L. A.). **The Problem of Codling Moth Control in Delaware.**—*J. econ. Ent.* **27** no. 1 pp. 225–229. Geneva, N.Y., February 1934.

In northern Delaware, where the orchards are old, small and scattered and only two generations of *Cydia* (*Carpocapsa*) *pomonella*, L., occur annually, one cover spray against each brood has invariably produced 98 per cent. uninjured apples; 40–80 miles further south, where 2½ broods occur and large orchards of different ages and varieties are in close proximity, adequate control requires 3 cover sprays for the first brood and one for the second, besides supplementary measures. The third first-brood spray was added after the first excessively heavy losses in 1930, when the dosage of lead arsenate was increased from 3 to 4 lb. with the addition of 1 U.S. pint fish oil to 100 U.S. gals. spray. Recent experimental evidence suggests the desirability of 3 nicotine-oil sprays to be applied in early July, late July and early August against the second brood. The usual supplementary practices are recommended. The concerted action of apple-growers in 1931–33 has substantially reduced infestation in certain districts. Orchards in which the 1930 crop was almost a total loss produced in 1933 over 90 per cent. uninjured fruit.

GOULD (E.). **Codling Moth Conditions and Control in West Virginia.**—*J. econ. Ent.* **27** no. 1 pp. 229–232. Geneva, N.Y., February 1934.

In the mountainous parts of West Virginia measures against *Cydia* (*Carpocapsa*) *pomonella*, L., can be entirely ignored in many apple orchards, but in the older and more densely planted valley sections, in spite of timely spray applications, the present loss often amounts to over 50 per cent., even when the crop is heavy. During light-crop years, when the concentration of the larvae is so heavy that the whole crop may be rendered worthless except for by-products, the entire crop should be picked and destroyed early, or else thoroughly sprayed.

Unless better control is effected, a large number of orchards will have to be abandoned. Factors governing the recent increase of the moth are discussed.

None of the many substitutes for lead arsenate tested has given definite promise. Representative data are given from tests of sprays of lead or calcium arsenate (3 lb. to 100 U.S. gals.) carried out in 1933, showing the percentage of infestation and corresponding residues, none having given significant control. Scraping and banding the trees has been found to be profitable, and orchard sanitation, which destroys the hibernation quarters of the larvae, added to the effectiveness of these measures. Thinning during years of heavy fruit-set and heavy pruning are valuable practices, allowing the spray to penetrate more effectively, and all infested fruit, whether windfalls or thinnings, should be destroyed.

Hodgkiss (H. E.), Worthley (H. N.) & Haley (D. E.). **Codling Moth in Pennsylvania.**—*J. econ. Ent.* **27** no. 1 pp. 232–239, 1 fig., 7 refs. Geneva, N.Y., February 1934.

Cydia (*Carpocapsa*) *pomonella*, L., is most injurious in the south-central districts of Pennsylvania, which are at a lower altitude. In the north and west, there is only one complete brood and a partial second; in the east, there is a full first brood and a smaller second in the upper half and a full first brood and a larger second in the central and lower half. Local areas of heavy infestation occur on the higher levels and along the main watercourses, but in the region of the Alleghanies control is easy. A graph is given showing the flight periods in 1925–33. Except in the area of extensive commercial orchards, a petal-fall spray and 3 cover sprays are sufficient. In isolated orchards 2 cover sprays give a large proportion of clean fruit, whereas in heavily infested areas 5 are required. The percentage of injury over the years 1929–33 varied from 1·3 to 2·6 where operations had been completely carried out and from 8·6 to 12·4 where orchards had been incompletely sprayed. Excessive residues were due either to higher concentrations of the arsenate or to delays in applying the last spray. The results of analyses for residual arsenic made in 1926–33 are shown in a table. In 1933, only 7 out of 475 samples showed (slightly) over 0·005 grain As_2O_3 per lb. apples, the maximum being 0·009 gr. Where two cover sprays of $2\frac{1}{2}$ lb. lead arsenate and 2 lb. powdered milk or three of 3 lb. calcium arsenate to 100 U.S. gals. were applied, the maximum was 0·002 gr. Residues analysed in 1933 from 58 samples collected in completely sprayed commercial orchards showed only 4 with a lead content above the 0·02 grain tolerance, the maximum being 0·03 gr. and the normal 0·004–0·009.

Experiments in 1931 showed the necessity for 4 first-brood cover sprays and the advisability of additional second-brood sprays in heavily infested orchards. In 1932, 5 cover sprays ending mid-July resulted in 0·028 gr. As_2O_3 per lb. at harvest. Evidence was obtained that the addition of casein or miscible oil would not allow of a reduction of the dosage of lead arsenate, and a complete cover spray schedule of nicotine tannate with flotation sulphur proved unpromising. Although fish oil (1 : 400) increased the effectiveness of the standard spray, it brought the arsenic residue above tolerance after only two cover sprays. Moreover, it cannot be mixed with lime-sulphur owing to the nauseating odour produced.

The effect of the growth of the apples in reducing the amount of arsenic per unit area of surface is discussed. During June, when the fruit was increasing rapidly in size, loss of arsenic per unit of surface was correspondingly high, and the need of accurate timing of spray applications to meet the periods of maximum egg hatching was manifest, even with intervals of only 10–15 days. If spraying stopped on 21st June, when the fruit was only 17 per cent. of its ultimate size, subsequent growth alone would reduce the deposit per unit area to one-sixth [*cf.* **17** 450].

Aldrich (J. M.). **Insects and Airplanes.**—*J. Econ. Ent.* **27** no. 1 p. 239. Geneva, N.Y., February 1934.

Salt-water gnats, almost certainly *Ephydra gracilis*, Packard, sucked into the air intake of the motor and into the screen of the carburettor of an aeroplane that had been forced down on a small island in the Great Salt Lake, Utah, and subsequently re-started, slowed the engine down to 900 revolutions and eventually occasioned a second forced landing. This fly has previously been accused of stopping railway trains.

Worthley (H. N.). **Codling Moth Spraying Experiments in Pennsylvania in 1933.**—*J. econ. Ent.* **27** no. 1 pp. 240–244. Geneva, N.Y., February 1934.

Details are given concerning the seasonal conditions prevailing and the results obtained in experiments for comparing the value of various spray combinations against *Cydia* (*Carpocapsa*) *pomonella*, L., including substitutes for arsenicals in later sprays.

The following is taken from the author's conclusions: With proper consideration for the suppression of other apple insects and diseases, the control of *C. pomonella* in heavily infested orchards in southern Pennsylvania can be best obtained with 3 lb. lead arsenate and 2–3 lb. skim milk powder per 100 U.S. gals. lime-sulphur, with the addition of nicotine sulphate in one application at the peak of oviposition of the moths of the overwintered generation. The schedule should provide four cover sprays for the first brood and one or two for the second. It will require washing to remove residues of arsenic and lead; otherwise a substitute for lead arsenate should be used after the third cover spray on the later varieties. Nicotine-oil is the most promising substitute, but its use is objectionable from the standpoint of cost and incompatibility with lime-sulphur. To avoid danger of injury, lime-sulphur should be omitted from the spray immediately preceding the oil-nicotine, and this points to the necessity for good early-season control of apple scab. Copper (cuprous) cyanide, which probably possesses fungicidal as well as insecticidal properties, was tested as a substitute for lead arsenate; although not highly effective at 2 lb. to 100 U.S. gals., it deserves further trial at increased concentration with an adhesive.

Smith (L. B.) & Hodgkiss (H. E.). **Modifying the Codling Moth Control Program.**—*J. econ. Ent.* **27** no. 1 pp. 244–249. Geneva, N.Y., February 1934.

A modified spraying programme for 1933, enabling apple-growers in Pennsylvania to obtain a fair degree of control of *Cydia* (*Carpocapsa*) *pomonella*, L., without the necessity of cleaning the fruit, consisted of

2½ lb. lead arsenate to 100 U.S. gals. in the first and second cover sprays and 2 lb. in the third and fourth, with the option of 3 lb. calcium arsenate in the third. The use of 2 lb. powdered skim milk as a spreader was advised, with the addition of 1 U.S. pint nicotine sulphate in the second cover spray, applied about the time when hatching reaches its maximum. Spraying was completed on 15th July instead of 1st August, and only 75 per cent. of the amount of lead arsenate used in the regular programme was applied.

The modified programme was tested in an orchard that, although sprayed, had lost 75 per cent. of the crop in 1932. The sprays applied were : delayed dormant on 24th April ; pink-bud on 3rd May ; petal-fall on 17th May ; and cover sprays on 2nd, 15th and 30th June and 18th July. Lime-sulphur was used as the fungicide in the first cover and the previous sprays. The usual 3 lb. lead arsenate was used in the first three sprays, and 2 lb. powdered milk was added in all the cover sprays and 1 U.S. pint nicotine sulphate in the petal-fall and first and second cover sprays. Temperature and humidity were both high at the time of the first cover spray, and although 3,700 U.S. gals. spray was applied to 292 trees, there was no appreciable russeting. Of apples examined on 26th August and at harvest, 0·4 and 0·1 per cent., respectively, were infested, and 16·4 and 35·9 per cent. "stung." Where the fourth cover spray had been omitted, the corresponding percentages on 26th August were 2 and 24·1. In a plot sprayed by the grower, where calcium arsenate had been used in the third cover, and the nicotine, the spreader and the fourth cover had been omitted, the percentages were 23·8 and 42·6 on 26th August, and 48 and 38 at harvest. There was 6 per cent. more damage on 26th August in the lower third than in the upper third of the trees. If the methods adopted in the experimental plot had been employed throughout the orchard, the value of the crop would have been about £9,000 more.

A comparison of practices in a number of orchards in eastern Pennsylvania showed that under commercial conditions the use of 3 lb. lead arsenate instead of 2½ lb. reduced damage by *C. pomonella* from 3·8 to 1·6 per cent. The percentage of injured fruit was 6·2 where calcium arsenate was used in the fourth cover spray, 30·2 where it was used in both third and fourth cover sprays, 39·5 where it was used in the third cover spray and the fourth was omitted, and 7 where lead arsenate was used in the first three cover sprays and the fourth omitted. In 1932, when 3 lb. lead arsenate was recommended for all cover sprays, 36 orchards completely sprayed yielded 373,300 bushels with 1·8 per cent. of the fruit damaged by *C. pomonella*, whereas unsprayed orchards showed 28·9 per cent. injury. Infestation in 1933 was much heavier, but where 3 lb. lead arsenate was used control was about the same. Reduction of the lead arsenate to 2½ lb. in 1933 gave about the same results as the omission of the final cover spray in 1932. The use of reduced dosages of lead arsenate will not be recommended in future, and efforts will be concentrated on obtaining effective control, even if it involves the removal of spray residues.

Driggers (B. F.) & Pepper (B. B.). **Comparative Tests of Arsenicals, Arsenicals with Oil and several Nicotine Compounds used against the Codling Moth.**—*J. econ. Ent.* **27** no. 1 pp. 249–258. Geneva, N.Y., February 1934.

In tests of various materials on apple in New Jersey in 1933 to control *Cydia* (*Carpocapsa*) *pomonella*, L., all blocks were sprayed alike

against the first and second broods on a ten-day schedule, except the nicotine sulphate-oil and nicotine tannate blocks, which were sprayed on a seven-day schedule against the second brood. Data obtained at the end of first brood and at harvest and by examining dropped fruit and collecting larvae under bands show clearly that nicotine tannate (3 U.S. pints liquid tannic acid and 1 U.S. pint 50 per cent. free nicotine to 100 U.S. gals. water) with bentonite sulphur [*cf. R.A.E.*, A **22** 283] (8 lb. against the first brood and 6 lb. against the second) was the most effective. Bentonite and compounds containing it have a marked power of fixing nicotine. The omission of the bentonite sulphur in the second-brood sprays increased infestation. Nicotine sulphate with bentonite, nicotine sulphate (1 U.S. pint with 2 lb. soap) with bentonite sulphur (8 and 6 lb.), 1½ U.S. pints nicotine tannate with oil (1 U.S. qt. Orthol K) and nicotine sulphate with oil produced more uninfested fruit than either 4 lb. lead arsenate or 2 lb. lead arsenate with 3 U.S. qts. summer oil, of which the latter was the less effective, possibly owing to a lowering of the ovicidal action of the oil in the presence of a heavy charge of solids. Calcium arsenate with or without oil (Orthol K) was not so effective as the lead arsenate, but caused no pronounced foliage injury, possibly owing to the hardiness of the trees and to the presence of other materials (milk and bentonite sulphur) in the spray.

The numbers of the moth were so greatly reduced by first-brood spraying that attack by the second brood was only about one-third as severe as that by the first, whereas it has usually been three or four times as great. Chemically treated bands, which were used during the season, no doubt helped to reduce the second brood. The larvae that did survive were principally those in the inadequately protected fruit at the tops of the trees. These experiments further demonstrate the importance of destroying the first-brood larvae by timely and thorough applications of whatever materials are selected.

Horsfall (J. L.) & Jayne jr. (D. W.). **A defoaming Material for Use in Apple Washing Machines.**—*J. econ. Ent.* **27** no. 1 pp. 259–261, 3 refs. Geneva, N.Y., February 1934.

The experience of other workers in the development of materials to control excessive foaming where degumming agents are used in washing solutions for the removal of arsenic and lead spray residues from apples is briefly reviewed [*R.A.E.*, A **20** 140; **22** 184]. The specifications necessary to any anti-foam material are set forth, and a list is given of 42 compounds tested in the laboratory. It was found that DeGras (wool grease), a complex mixture of esters of fatty acids and of alcohols of high molecular weight, mixed with naphtha (1 : 1) to secure mobility, controlled foam satisfactorily under laboratory conditions. A 0·3–0·5 per cent. concentration was effective in field tests in New Jersey with two types of washer in which apples carrying an exceptionally heavy residue were washed with 1·75 per cent. HCl and 1 per cent. Vatsol. DeGras is inexpensive, has no unpleasant odour and does not injure the fruit or interfere with residue removal.

Blanchard (R. A.) & Dudley jr. (J. E.). **Alfalfa Plants resistant to the Pea Aphid.**—*J. econ. Ent.* **27** no. 1 pp. 262–264. Geneva, N.Y., February 1934.

Field observations in California during 1930–33 showed that on some lucerne plants that had been heavily infested by *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) the Aphids had died before causing noticeable

injury. Cuttings were made from these, and 70 resulting plants were planted during the autumn of 1932 in a field where severe damage from Aphids had occurred yearly. Attempts to establish Aphid colonies on them in 1933 were unsuccessful.

In tests with potted lucerne plants in Wisconsin, 186 adults and late-instar nymphs of *M. onobrychis* were caged with 23 plants derived from 2 that had proved to be resistant. At the end of the second day, 72 newborn Aphids were observed, but their numbers subsequently decreased, and none remained at the end of 16 days. In a starvation test in which 247 adults and fourth-instar nymphs were confined with resistant plants in fine-mesh cages on moist sand, none was found after 6 days, whereas those on control plants multiplied rapidly. Plants derived from the resistant ones by seed were equally immune. Adults confined on resistant plants shrank rapidly, and the majority were restless, dropped readily from the plants and tried to crawl away. In all the tests, the higher the average (and especially the maximum) temperature, the sooner the Aphids died.

SHULL (W. E.), RICE (P. L.) & CLINE (H. F.). *Lygus hesperus* **Knight (Hemiptera, Miridae) in Relation to Plant Growth, Blossom Drop and Seed Set in Alfalfa.**—*J. econ. Ent.* **27** no. 1 pp. 265–269, 2 refs. Geneva, N.Y., February 1934.

The occurrence of blossom drop of lucerne in conjunction with feeding by Capsids has been noticed in Utah [*R.A.E.*, A **20** 534], and field observations in Idaho, where *Lygus hesperus*, Knight, and *L. elisus*, Van Duzee, are found in large numbers [**22** 214], have shown that where the Capsid population is high in lucerne seed fields there is often a heavy loss in the seed crop. *Lygus pratensis*, L., is not now known to be present in Idaho [**22** 94].

In a field test in Idaho, the weight of hay from a crop of lucerne grown under a cage where the numbers of *L. hesperus* and *L. elisus* were kept approximately proportionate to their incidence in the surrounding fields was 17·5 per cent. less than in cages from which the bugs were excluded. Adults of *L. hesperus* were caged on 10th July, in batches of 4 comprising both sexes or males only, over individual lucerne plants the blossoms of which had been artificially fertilised. On 25th July, no pods had been formed in any of these cages except 3 in which all the bugs had died before 19th July, whereas they had been formed in all the control cages except 3 in which the flowers had been injured or not successfully pollinated. In similar tests with plants of which the pods had already filled out, some of the pods in infested cages were punctured, and the seeds in them were pitted or shrivelled. As most of the seeds thus injured are probably light enough to be blown out of machine-cleaned seed, this type of injury does not affect its market value, but merely reduces the yield.

KNIGHT (Hugh) & CLEVELAND (C. R.). **Recent Developments in Oil Sprays.**—*J. econ. Ent.* **27** no. 1 pp. 269–289, 3 figs., 5 refs. Geneva, N.Y., February 1934.

The incorporation in petroleum oils used for sprays of glycerides of the higher fatty acids or other hydroxy esters of organic acids that have high molecular weight and certain salts containing polyvalent cat-ions has been found to retard the penetration of the oil into fruit and leaf tissues, thus producing a more uniform film and prolonging the

period of toxicity to certain insects. The alteration effected in the physical characteristics of the oil is discussed in detail. These compounds also serve as efficient internal oil-soluble emulsifiers. Emulsification is effected by pouring the oil into the spray tank together with a few gallons of water ; this is taken by suction through the pump and returned to the overflow by-pass. Emulsification is instantaneous and complete, and only moderate agitation is required in adding further water.

In tests against the codling moth [*Cydia pomonella*, L.], 1–2 per cent emulsions of a white oil (80–85 secs. viscosity) containing 5 per cent glyceryl oleate or a combination of 5 per cent. aluminium naphthenate and 0·5 per cent. glyceryl naphthenate gave respectively 8·3 and 15·6 per cent. better control than the usual 1 per cent. summer oil plus calcium arsenate (3 lb. to 100 U.S. gals.). In tests against the pear psylla [*Psylla pyricola*, Först.], the percentages of uninfested leaves on 8th August on trees sprayed with these two oils were respectively 31·3 and 89·9, as compared with 2·8 on those sprayed with the usual summer oil emulsion. These oils appear reasonably safe for use on *Citrus* as well as on deciduous fruit trees, but further study is required to perfect them for practical commercial use.

Pepper (J. H.). **Catalase Content and Mortality of Insects exposed to lethal Temperatures.**—*J. econ. Ent.* **27** no. 1 p. 290. Geneva, N.Y., February 1934.

It has been thought that the mortality of insects exposed to high temperatures might be due to inactivation of the enzymes and that unless this was complete they would revive. In an experiment with adults of *Tribolium confusum*, Duv., however, none of which revived after exposure to 118°F. for 6 hours, 10 determinations made at hourly intervals showed no relation between catalase content and mortality. A gradual inactivation of the enzyme was brought about, but no abrupt change took place even after 100 per cent. mortality had been produced.

Searls (E. M.). **Starved Horn-worm Larvae make excellent Laboratory Material.**—*J. econ. Ent.* **27** no. 1 p. 290. Geneva, N.Y., February 1934.

To determine the effect of starving larvae required as specimens for examination of the internal structures, full-grown, actively feeding larvae of the tobacco hornworm [*Protoparce*] were kept at about 17°C. [62·6°F.] without food. Each day for 8 days, a preservative composed of 120 cc. water, 15 cc. alcohol and 7 cc. formaldehyde was injected into 10 of them, which were then placed in a jar of the same preservative. When examined 3 months later, larvae that had been starved for 6 days had very little fat left within the haemocoele, and the visceral organs were fully exposed. After the sixth day, there was no further significant change.

Gilmore (J. U.) & Milam (J.). **A new Pest in Tobacco Plant Beds, *Limnobia ultima* O.S.**—*J. econ. Ent.* **27** no. 1 pp. 290–291. Geneva, N.Y., February 1934.

Damage to tobacco seedlings was caused in Tennessee in April 1932 by larvae of the Tipulid, *Limonia* (*Limnobia*) *ultima*, O.-S., which, without

actually feeding on the plants, caused excessive aeration and evaporation of soil moisture by working in the soil surface, so that the plants wilted and died from drought. Losses were not over 5–10 per cent. in any of the beds examined, but damage might have been much greater if frequent rains had not kept the soil compact and moist until the seedlings were able to establish a deeper root system. Drenching the beds with 4 gm. potassium permanganate or 10 cc. nicotine sulphate to 1 U.S. gal. water killed some larvae within a few minutes and effectively controlled the infestation.

Wilson (H. F.). **Will Fluorine Compounds be accepted as Insecticides ?** —*J. econ. Ent.* **27** no. 1 p. 291. Geneva, N.Y., February 1934.

In an experiment to determine to what extent rock phosphate, which contains fluorine, might be used in place of bone meal in animal rations, a serious toxic effect was produced at the lower levels of substitution. Data from these and other experiments, shortly to be published, show conclusively that fluorine is extremely dangerous in amounts near the tolerance now allowed when it is used in insecticides.

Hammer (O. H.). **Experiments with Kerosene against Apple Maggot Pupae.**—*J. econ. Ent.* **27** no. 1 pp. 291–292. Geneva, N.Y., February 1934.

Kerosene emulsions that had already proved toxic to adults of *Tachypterellus quadrigibbus*, Say (apple curculio) were tested in New York against overwintered pupae of *Rhagoletis pomonella*, Walsh. On 16th June 1933, one-half of each of 7 areas of sod ground (4 × 6 ft.) on which an even layer of heavily infested apples had been spread in the previous autumn was sprayed with kerosene emulsified by means of a finely divided clay (1 lb. per U.S. gal. kerosene). The emulsions were applied with a knapsack sprayer at the rate of 1 U.S. qt. per sq. ft. of surface. In cheesecloth cages placed over each area, the first flies appeared on 24th June. None emerged from areas sprayed with 50 or 25 per cent. kerosene alone or 50 per cent. of a saturated solution of either naphthalene or paradichlorobenzene in kerosene ; 10 per cent. kerosene alone and with paradichlorobenzene, and 25 per cent. kerosene with naphthalene, all killed over 95 per cent., as estimated by comparison with the control half of each area.

Osburn (M. R.). **Experiments with Rotenone and Derris to repel the Japanese Beetle** (*Popillia japonica* **Newm.**).—*J. econ. Ent.* **27** no. 1 p. 293. Geneva, N.Y., February 1934.

Injury by *Popillia japonica*, Newm., to peach and apple was considerably reduced in 1932 by the application of 5 sprays each of 0·2 lb. 90 per cent. rotenone to 100 U.S. gals. water, but less concentrated sprays were less effective. In 1933, sprays of 0·1 or 0·2 lb. rotenone, with or without 0·4 U.S. gal. summer oil, or 2·5 or 5 lb. derris root (4 per cent. rotenone), with or without 0·4 U.S. gal. summer oil, were applied weekly to a number of varieties of apple and peach ; additional sprays were applied immediately after heavy rains, but not more than 6 applications were made in all. The unsprayed trees were rapidly defoliated, and some traces of feeding were seen on those sprayed with

rotenone, but very few beetles were found on those sprayed with derris. Both insecticides were more effective with oil, but derris alone was better than rotenone and oil.

MANNS (T. F.). **Our Present Knowledge on the Dissemination of Yellows and Little Peach.**—*Trans. Peninsula hort. Soc.* 1933 pp. 17–19, 1 ref. Dover, Del. [1934.]

Investigations carried out during 1933 in Delaware and adjacent States showed that plums constitute a source of infection of yellows and little-peach diseases of peach without showing marked symptoms. *Macropsis trimaculata*, Fitch, the probable vector of these virus diseases [*cf. R.A.E.*, A **21** 192], was found on all varieties of plum with rough bark, whereas peach was rarely attacked and usually only when growing under poor conditions. It thus appears that, for the control of the diseases, the Jassid should be dealt with on plums or these trees eliminated from the orchards and their vicinity.

STEARNS (L. A.), MACCREARY (D.) & HADEN (W. R.). **Experience, during 1933, with Arsenicals and Arsenical Substitutes applied on Apple for Control of Codling Moth.**—*Trans. Peninsula hort. Soc.* 1933 pp. 20–28. Dover, Del. [1934.]

The changes effected during the last 4 years in the spray programme for the control of the codling moth [*Cydia pomonella*, L.] on apples in Delaware and the status of this pest in 1933 are briefly reviewed [*R.A.E.*, A **22** 290]. In experiments in 1933, the most effective schedule consisted of three cover sprays of 4 lb. lead arsenate, 10 lb. flotation sulphur and 5 lb. hydrated lime in 100 U.S. gals. water, with the addition of fish oil in the first and second (1 U.S. pint and 1 U.S. qt., respectively), against the first brood, and three of 1 U.S. pint nicotine sulphate, 1 U.S. gal. oil (Orthol K) and 8 lb. hydrated lime in 100 U.S. gals. Bordeaux mixture (4 : 10) against the second brood. The standard treatment, in which the same three cover sprays are applied against the first brood and a fourth of 3 lb. lead arsenate and 5 lb. hydrated lime in 100 U.S. gals. Bordeaux (5 : 10) against the second brood was next in effectiveness. Not more than 10 per cent. of the apples harvested were infested after either treatment. Neither manganese arsenate nor nicotine tannate was satisfactory.

HOUGH (W. S.). **Codling Moth Control in Virginia.**—*Trans. Peninsula hort. Soc.* 1933 pp. 35–38. Dover, Del. [1934.]

In Virginia, satisfactory control of the codling moth [*Cydia pomonella*, L.] during a heavy outbreak, such as occurred in 1933, can probably be obtained only by continuous spraying from petal-fall until about 25th June against the first brood and further applications from mid-July to early August against the second, making at least 6 in all. The fruit would require washing to remove residues. The spread of moths that have overwintered as larvae in picking boxes or packing sheds can be checked by storing the boxes in a tightly closed room after use in autumn and by doubling the number of sprays on trees within 500 ft. [*cf. R.A.E.*, A **21** 223] of the sheds and scraping and banding them.

In the laboratory, calcium arsenate was less effective than lead arsenate in preventing the larvae entering the fruit. In the field, however, though it was less satisfactory in a heavily infested orchard,

it was as efficient as other materials in a lightly infested one. The addition of 1 per cent. summer oil to three sprays greatly increased the effectiveness of a spray of calcium arsenate and Bordeaux mixture, the use of which latter is essential to prevent arsenical injury, a rate of 1 : 3 : 50 being sufficient for this purpose. A spray of 1 gal. summer oil and 1 pint nicotine sulphate to 100 gals. gave about the same degree of control as lead arsenate. It would have to be applied every 8–10 days during the chief period of oviposition.

McLean (H. C.) & Weber (A. L.). **How the State of New Jersey meets the Spray Residue Situation.**—*Trans. Peninsula hort. Soc.* 1933 pp. 43–50. Dover, Del. [1934.]

A programme is suggested for the control of the codling moth [*Cydia pomonella*, L.] in New Jersey as a result of 2 years' work on sprays and the removal of excessive residues [*R.A.E.*, A **22** 283]. It is stated here that residues may be effectively removed with hydrochloric acid alone provided that oil and lead arsenate is not applied more than 37 days after petal-fall and lead arsenate and non-casein spreader not more than 57 days [*cf. loc. cit.*]. The addition of a wetting agent is considered necessary for washing fruit sprayed with 3 U.S. qts. medium summer oil and 2 lb. lead arsenate to 100 U.S. gals. 57 and 67 days after petal-fall. Small fruits and some vegetables may be treated for the removal of residues from sprays of Bordeaux mixture and of lead arsenate by immersion for 1–2 mins. in solutions of 1 per cent. acetic acid and 3 per cent. hydrochloric acid, respectively, followed by thorough rinsing.

Cory (E. N.). **The Codling Moth Situation on the Eastern Shore of Maryland.**—*Trans. Peninsula hort. Soc.* 1933 pp. 58–60. Dover, Del. [1934.]

In 1933, apples sprayed throughout the season with calcium arsenate were not more severely injured by larvae of the codling moth [*Cydia pomonella*, L.] than those treated with lead arsenate in the first cover spray and in earlier sprays and then with calcium arsenate. A campaign is suggested for the reduction of the hibernating larvae by scraping, clearing up débris and removing unprofitable trees.

Farley (A. J.). **Peach and Apple Spraying Experiences in New Jersey.** —*Trans. Peninsula hort. Soc.* 1933 pp. 69–74. Dover, Del. [1934.]

Considerable injury was caused in 1933 to apple in New Jersey by green and rosy aphis [*Aphis pomi*, DeG., and *Anuraphis roseus*, Baker], which appeared unusually early and remained on the trees longer than they had done for several years, apparently owing to favourable weather and a scarcity of parasites. The difficulty of applying the oil emulsion-cresylic acid spray against Aphids [*R.A.E.*, A **20** 81] and lime-sulphur against scab within the relatively short delayed dormant period may possibly be avoided by the application of a combination of Coposil (3 lb. powder or 3 U.S. gals. paste), sufficient oil emulsion without cresylic acid to give 3 per cent. actual oil and $\frac{1}{2}$–$\frac{3}{4}$ U.S. pint nicotine sulphate in 100 U.S. gals. at the late delayed dormant period. This spray should be effective against Coccids, red mite [*Paratetranychus pilosus*, C. & F.], Aphids and scab. The most economical and effective method of destroying the hibernating larvae of the codling

moth [*Cydia pomonella*, L.] appears to be scraping the rough bark from the trunks and main branches and applying pine oil [**21** 223] to areas difficult to scrape. Spraying experiences [**22** 294] indicated that 5–6 lb. solids in the form of lime, Bordeaux or Coposil is probably the maximum that can be added to sprays containing 2 lb. lead arsenate and 3 U.S. qts. summer oil without reducing the insecticidal value of the oil. Five cover sprays applied thoroughly, particularly to the tops of the trees, at 10-day intervals beginning 7 days after petal-fall are recommended for the control of the first brood.

Crosthwait (S. L.). **The more important Insect Outbreaks on the Eastern Shore of Maryland, 1933.**—*Trans. Peninsula hort. Soc.* 1933 pp. 75–78. Dover, Del. [1934.]

Cirphis unipuncta, Haw., migrated to wheat, potatoes, maize, tomatos and other plants on the mowing of hay fields. Fields were successfully protected from invasion by ploughed furrows, containing post-holes into which the larvae fell, and a bait of bran and molasses poisoned with an arsenical was broadcast in the late afternoon at the rate of 8–12 lb. per acre during the first two weeks in June. This outbreak was shortly followed by the appearance of the Pyralid, *Monoptilota nubilella*, Hulst. (lima bean stem-borer), the larvae of which bore in the stalks of lima and other beans, causing a swelling. Two annual generations apparently occur in Maryland. Autumn ploughing was recommended for the control of the hibernating larvae. In general *Diatraea crambidoides*, Grote (*zeacolella*, Dyar) was less injurious to maize than in 1932. Two generations develop annually, the second hibernating in the stubble, which should therefore be destroyed. *Epilachna corrupta*, Muls. (Mexican bean beetle) was numerous on cowpeas [*Vigna*] and soy beans. Turning under all old bean plants immediately after harvest is of considerable value in its control. Damage was caused to tomatos by *Protoparce sexta*, Joh., and *Heliothis obsoleta*, F., against which a dust of 1 lb. calcium arsenate and 3 lb. hydrated lime gave fairly good results. Fruit picked green should be wiped with a damp cloth to remove any residue. A spray of Bordeaux mixture (4 : 4 : 50) and 2 lb. calcium arsenate was effective against the potato flea-beetle [*Epitrix cucumeris*, Harr.].

Crosby (C. R.), Mills (W. D.) & Blauvelt (W. E.). **Protecting Orchard Crops from Diseases and Insects.**—*Bull. Cornell Univ. Agric. Exp. Sta.* no. 498 (revd) 83 pp., 18 figs. Ithaca, N.Y., December 1933. [Recd. April 1934.]

This revised edition [*cf. R.A.E.*, A **18** 279 ; **20** 248] includes notes on the control of *Cydia* (*Laspeyresia*) *molesta*, Busck, on quince in New York. Spraying twice a month (a calyx and 6 cover sprays) with 2½ lb. lead arsenate and 2 U.S. gals. summer oil in 100 U.S. gals. water gave 96 per cent. uninjured fruit in 1933, and the residue was easily removed. To make washing unnecessary, 1 U.S. pint nicotine may be substituted for the arsenical in the last four sprays. On the basis of spraying experiments [**22** 179 ; etc.], recommendations are made for the use of tar distillate emulsions containing different percentages of tar oil and petroleum oil against various apple pests, with the addition of further petroleum oil against *Aspidiotus perniciosus*, Comst.

Smith (R. C.). **Summary of the Population of injurious Insects in Kansas for 1933—the Third Annual Summary.**—*J. Kansas ent. Soc.* **7** no. 2 pp. 37–51, 3 refs. McPherson, Kans., April 1934.

Records of the insect populations in Kansas were obtained in 1933 as in previous years [*R.A.E.*, A **21** 289; etc.] and are presented in compact tabular form together with notes on the more striking examples.

Caesar (L.) & Ross (W. A.). **Insects of the Season 1932 in Ontario.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 13–20. Toronto, 1933. [Recd. March 1934.]

Brief notes are given on a large number of insect pests observed in Ontario during 1932.

An outbreak of *Erythroneura comes*, Say, and *E. tricincta*, Fitch, occurred on grape vines in one district. The eggs were markedly susceptible to nicotine, and experiments showed that it is possible to obtain complete control of an outbreak in one year by nicotine sprays. The larvae of *Disonycha xanthomelaena*, Dalm., were numerous for the first time on sugar-beet leaves in the western part of the Province; this Halticid also severely injured horse-radish in one county. *Bourletiella* (*Smynthurus*) *hortensis*, Fitch, seriously damaged seedling cucurbits in the spring, near Ottawa. Large numbers were found on young *Gladiolus* plants during June, but very little injury occurred. *Cicadula divisa*, Uhl., was abundant on lettuce in one field in this district, causing wrinkling and discoloration of the leaves and sometimes stunting the heads.

Ross (W. A.), Armstrong (T.) & Patterson (D. F.). **Notes on Pear Psylla and San José Scale Control.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 21–24. Toronto, 1933. [Recd. March 1934.]

In laboratory experiments in Ontario, a spray of 3 gals. each of lubricating oil and water and 6 oz. calcium caseinate in 100 gals. lime-sulphur (1 : 9) was as effective as the usual 3 per cent. lubricating oil spray [*cf. R.A.E.*, A **21** 281] in preventing oviposition on pear by the pear Psyllid [*Psylla pyricola*, Först.] and killed over 95 per cent. of the eggs, as compared with a maximum of 28 per cent. In the orchard, this spray did not injure the trees and gave excellent control of the Psyllid without extra summer sprays.

In the laboratory, on apple twigs infested with San José scale [*Aspidiotus perniciosus*, Comst.] collected in late winter, all the scales were killed within 12 days by a spray of 3 or 4 per cent. lubricating oil emulsion and within 31 days by the same concentrations in Bordeaux mixture (3 : 6 : 40). Lime-sulphur (1 : 7) killed 97·7 per cent. in 31 days and may have sterilised the others [*cf.* **18** 70]. Similar results were obtained from dormant sprays in the field. The seasonal conditions during the year were, however, unfavourable for a large increase in infestation by the scale.

Armstrong (T.). **Studies on the Effect of Burying and of Cultivation on Larvae of the Oriental Fruit Moth.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 24–29, 4 figs. Toronto, 1933. [Recd. March 1934.]

Of larvae of *Cydia* (*Grapholitha*) *molesta*, Busck (in cocoons in corrugated paper) placed on the surface of the soil or buried at a depth of

2, 4 or 6 inches in Ontario in November 1930 and 1931 (the figures for the latter year being given in brackets), the percentage mortalities were respectively 65 (77·3), 81·7 (77), 86 (88·7) and 98 (93·3). For experiments in April 1930 and 1931, the corresponding percentages were 12·2 (12), 69·2 (55·6), 74·2 (76·9) and 79·5 (87·5), and in May, when most of the larvae had pupated, 29 (12), 87·7 (97·3), 94·5 (98) and 98·7 (99·3). In experiments in which the larvae were dug into the ground in April to 4 or 5 inches and the land was either left uncultivated or cultivated at weekly intervals by hand or by double-disking with a tractor outfit, the percentage mortalities in 1930 (and 1931) were 73 (71·5), 86·9 (87·3) and 99·9 (100). The survival of buried larvae is due to their making their way to the surface and spinning fresh cocoons. When pupae are buried, no emergence is possible.

Dustan (G. G.) & Armstrong (T.). **Observations on the Relation of Temperature and Moisture to the Oriental Peach Moth.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 29–39, 4 graphs. Toronto, 1933. [Recd. March 1934.]

Observations in the Niagara Peninsula showed that in 1928 and 1930 most of the overwintered larvae of the oriental peach moth [*Cydia molesta*, Busck] pupated during a few days of unseasonably high temperature (in early April). In the laboratory, the pupal period varied from 53 days at a mean temperature of 48·5°F. to 12 days at 68·7°F. The maximum emergence from pupae on the south side of a tree occurred more than two weeks earlier than on the north. About 98 per cent. of the eggs were usually laid in the late afternoon and the other 2 per cent. during the morning and early afternoon, especially on cloudy days. In cages, eggs were laid on a bright day under artificial shade and at night by electric light. None was laid below 57–58°F., and few below 65°F., when the activity of the adults was reduced. The optimum temperature for oviposition was 90–94°F. Low temperatures shortly after emergence prolong the lives of the adults and delay oviposition to a time when the peach twigs are further advanced and more able to support the larvae. When adults were kept in dry cages without water, their life-span was approximately halved and egg-production was reduced by just over 75 per cent., and during the comparatively dry summers 1930 and 1931 the moth was relatively scarce over its eastern range.

In summer the incubation period was 4–7 days, in spring and autumn 10–15, and in October sometimes as long as 20–34. It was prolonged in shaded spots. The larvae developed rather more quickly when fed on peach shoots than on fresh peaches or apples. The feeding period was longer for a number of larvae in a single fruit. It ranged from 9 days at an average temperature of 76°F. to 80–92 at 46·5°F.

Wishart (G.) & Thomas (I. E.). **Recent Developments in the Corn Borer Parasite Situation in eastern Canada.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 39–41. Toronto, 1933. [Recd. March 1934.]

Work on the biological control of *Pyrausta nubilalis*, Hb., in eastern Canada during 1923-32 is briefly reviewed. In 1932, 98,682 adults of imported parasites and cocoons of two other species that yielded 5,927 adults were received from the United States and liberated in June–September, together with 24,125 adults bred in the laboratory at Belleville. Collections of approximately 100 host larvae were made at all

places of liberation, and also others at varying distances from the starting points to determine the rate of dissemination. Part of each collection was dissected and the rest used for rearing.

The following figures show the average and (in brackets) maximum percentage of parasitism by the more successful parasites in maize fields in which they were released: *Angitia* (*Inareolata*) *punctoria*, Rom., 8 (37); *Chelonus annulipes*, Wesm., 2 (16); Dipterous parasites 2·5 (19·5); *Cremastus flavo-orbitalis*, Cam., 8·5 (13); and *Macrocentrus gifuensis*, Ashm., 2 (16). The figures for *M. gifuensis* are doubtful, because it overwinters in the host as an undeveloped egg invisible to the naked eye. The best period for liberating *Chelonus*, which oviposits in the eggs of the host, was the first three weeks of July, and for parasites that attack the young larvae from 22nd July to 10th August. The parasites recovered were nearly all hibernating.

CAESAR (L.). **The Corn Borer Situation in Ontario in 1932.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 41–45. Toronto, 1933. [Recd. March 1934.]

As compared with 1931 [*cf. R.A.E.*, A **21** 288], infestation of maize by the corn borer [*Pyrausta nubilalis*, Hb.] increased in the majority of the counties subject to the Corn Borer Act, but decreased in some. The author considers that the differences in degree of infestation were due to weather conditions and not to any variation in carrying out the provisions of the Act. The critical period as regards weather is June, July and about the first week of August, that is the time of oviposition, hatching and establishment of the young larvae in the plant. The optimum conditions for the insect at this time are warmth and moisture, without violent storms. If the weather is dry, the adults cannot obtain water, and so die early and lay fewer eggs than normal, and a large percentage of the egg clusters are loosened and drop from the leaves. Hot, dry conditions also destroy many young larvae before they can establish themselves in the plants. In 1925, 90 per cent. of the young larvae perished in this manner, and similar cases were recorded in 1930 and 1932. Strong winds and heavy driving rains also do much to reduce oviposition and to destroy young larvae.

MITCHENER (A. V.). **The Grasshopper Campaign in Manitoba in 1932.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 45–48, 2 figs. Toronto, 1933. [Recd. March 1934.]

A severe outbreak of *Camnula pellucida*, Scudd., *Melanoplus bivittatus*, Say, and *M. mexicanus*, Sauss., in Manitoba in 1932 was effectively controlled by a poisoned bait of 50 lb. bran, an equal volume of sawdust, 2 qts. liquid sodium arsenite (containing 2 lb. As_2O_3), 2 lb. salt and 10–12 gals. water. Malt sprouts proved a cheap and effective substitute for bran. The materials were mixed in a Manitoba mixer [*R.A.E.*, A **9** 259]. In experiments in the summer of 1931 and 1932 with various poisons in baits of bran, etc., the addition of salt appeared to be of little value. Sodium fluosilicate gave an average mortality of 78 per cent., and was more efficient when used without salt. In limited work, calcium arsenate and sodium fluoride both gave over 90 per cent. control. Calcium fluosilicate had little toxic effect. The sodium arsenite formula given above appeared to be the most effective and economical poison. About 16,660 tons of bait were prepared in the

course of the 1932 season, at a total cost for ingredients of about £23,000 [at par], and it is estimated that the crops saved as a result of the campaign included 24 million bushels of wheat, oats and barley.

MacAndrews (A. H.). **The Control of the Locust Borer by Forest Management.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 48–50, 1 graph. Toronto, 1933. [Recd. March 1934.]

Attempts to control *Cyllene robiniae*, Forst., the worst pest of black locust [*Robinia pseudacacia*] in many parts of the United States, by excluding sunlight or by eradicating golden-rod [*Solidago*] [*cf. R.A.E.*, A **9** 467] have not proved successful. In a stand of about 1½ acres of sprout growth locust in New York that had grown up since 1921, the average infestation of all crown classes was nearly the same (17·1 borers to a tree), but there was a high larval mortality in the co-dominant trees. Examination of 767 felled trees from this stand showed that those with a diameter of less than 2½ inches were all equally infested ; over 2½ inches, however, there was an increasing rate of attack in trees of the suppressed class, whereas in intermediate, and more markedly in co-dominant trees, infestation decreased in those over 3 inches. Suppressed trees of 2-inch diameter seemed to offer the optimum breeding conditions. These data suggest the possibility of controlling this Cerambycid by removing the suppressed and intermediate trees.

About 21 examples of *Ephialtes* (*Ichneumon*) *irritator*, F., were reared from the larvae. The adults appeared a week before the peak of emergence of the borer, which occurred in the first week in September. The first adult of the latter appeared on 4th August, and the first eggs were found at the end of August and hatched in about 6 days. Oviposition continued as late as 1st October, and a few adults were found until 28th October.

Stirrett (G. M.) & Arnott (D. A.). **Insects infesting Grain in Farmers' Granaries in southwestern Ontario.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 50–54, 3 refs. Toronto, 1933. [Recd. March 1934.].

Storage in unsuitable conditions and the practice of taking in the screenings from elevators were probably two causes of severe infestation of grain by insects in south-western Ontario in 1931 and 1932. The most injurious species were *Calandra* (*Sitophilus*) *oryzae*, L., *C.* (*S.*) *granaria*, L., *Silvanus* (*Oryzaephilus*) *surinamensis*, L., and *Tribolium castaneum*, Hbst. (*ferrugineum*, F.). The Tenebrionid, *Alphitophagus bifasciatus*, Say, and the Mycetophagid, *Typhaea stercorea*, L. (*fumata*, L.), were primarily saprophytic. *Laemophloeus minutus*, Ol., *L.* (*Cryptolestes*) *ferrugineus*, Steph., *Cathartus advena*, Waltl, *Tenebroides mauritanicus*, L. (cadelle), Psocids and mites were also found.

Moving and turning the grain delays infestation, and at 45°F. there is very little insect activity. If the grain is put through a fanning mill at the time of turning, large numbers of adults and larvae will be eliminated, but the stages of the species of *Calandra* within the grains will not be affected. Fumigation with a mixture of carbon bisulphide, carbon tetrachloride and sulphur dioxide (2 gals. to 1,000 bushels) gave good results. During the fumigation, the temperature of the grain should not be lower than 70°F., and it should be kept covered with canvas.

Finlayson (L. R.). **Some Notes on the Biology and Life-history of Psocids.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 56–58, 2 refs. Toronto, 1933. [Recd. March 1934.]

An outbreak of *Liposcelis divinatorius*, Müll., occurred in a room at Belleville, Ontario, containing 62 bushels of soft wheat that was being used to rear *Sitotroga* [*cerealella*, Ol.] as a host for *Trichogramma*. The temperature was 75–85°F. and the relative humidity 75–90 per cent., but inside the boxes of wheat the temperature was often higher and the relative humidity probably lower. The room was uninfested at the beginning of 1932, and the invasion was first noticed, outside the boxes, towards the end of March. By May the Psocids had spread to the wheat and were so numerous that general spraying of the room and the outside of the boxes with a pyrethrin spray was useless. In August the population was estimated at over 2,000,000. The Psocid was found feeding readily on *Sitotroga* eggs, and if starved would even devour the chorion. The period from egg to adult lasted about one month at 80°F. and a relative humidity of 65 per cent. There were three moults. After a pre-oviposition period of 2–3 weeks, eggs were laid at the rate of one every 12 hours, until 75 per cent. of the total was reached, after which they were deposited at longer intervals [*cf. R.A.E.*, A **18** 417]. A more active species of Psocid, probably *Trogium* (*Clothilla*) *pulsatorium*, L., which also devoured *Sitotroga* eggs, was found at the same laboratory.

Sheppard (R. W.). **The present Status of the European Pine Shoot Moth in southern Ontario.**—*Rep. ent. Soc. Ontario 1932* **63** pp. 58–61. Toronto, 1933. [Recd. March 1934.]

The status of *Rhyacionia buoliana*, Schiff., and the measures used against it from 1926 to 1931 in the Niagara Peninsula [*cf. R.A.E.*, A **19** 34] are briefly discussed. Only partial control has been achieved, and new infestations have arisen in the Niagara border area each season. This may be due to migration of adults from heavily infested plantations in New York State, possibly attracted by the powerful searchlights on the Canadian side. A plantation of Scots pines [*Pinus sylvestris*] 25–30 years old nearly hidden by a growth of deciduous trees was probably one source of the heavy infestation in the Lake Erie area.

In addition to two introduced parasites [*loc. cit.*], the following native species have been observed: *Pimpla detrita*, Hlmgr., *P. inquisitor*, Scop., *Hemiteles* sp., *Ephialtes extensor*, Tasch., *Pristomerus orbitalis*, Hlmgr., *Lissonota culiciformis*, Grav., *Perilampus tristis*, Mayr, *Habrocytus* sp., *Microbracon stabilis*, Wesm., *Eurytoma appendigaster*, Swed., and *Euderus* (*Secodella*) *subopacus*, Gah.

Cunningham (H. S.). **Report of the Plant Pathologist, 1931.**—*Rep. Dep. Agric. Bermuda 1932* pp. 50–52. Hamilton, 1933.

Russell (T. A.). **Report of the Plant Pathologist, 1932.**—*T.c.* pp. 24–30.

Some of the insects recorded from Bermuda in these reports have been noticed from a subsequent one [*R.A.E.*, A **22** 253]. The Coccid attacking *Juniperus bermudiana* [**20** 101], two outbreaks of which occurred in 1931, has been identified as *Chrysomphalus agavis*, Tns. & Ckll. It was parasitised by *Aphytis* (*Aphelinus*) *diaspidis*, How., and *Aspidiotiphagus citrinus*, Cwfd. In experiments in which lily

bulbs were treated for 30 mins. in hot water against bulb mites [*Rhizoglyphus hyacinthi*, Banks], the vitality of the bulbs was not seriously affected at 119°F. and control was not obtained below 111°F. In 1932, damage was caused to tomatos by larvae of *Phthorimaea lycopersicella*, Busck, which were heavily parasitised by *Angitia blackburni*, Cam. *Protoparce* (*Phlegethontius*) *sexta*, Joh., and *Psara periusalis*, Wlk., destroyed tomato foliage, and the latter defoliated potato in some fields in autumn. *Aulacaspis pentagona*, Targ., was abundant on oleander early in the year, but decreased towards the summer. Imported iris bulbs were found to be infested by *Anuraphis tulipae*, Boy., and were destroyed.

Phthorimaea operculella, Zell., severely injured stored potatoes in 1931 and 1932, sometimes destroying the buds in the eyes. As attacks on the tubers is confined to the summer, it will not affect crops for export. In the autumn, larvae were found mining the leaf-blades and petioles only. They were highly parasitised, and *Angitia blackburni* was reared from 10 out of 11 larvae collected during November–December. Those attacking the tubers in summer, however, were rarely parasitised. Measures recommended include the addition of lead arsenate to the usual Bordeaux spray, thoroughly earthing-up the plants to protect them from attack, storing the tubers for as short a period as possible, and fumigation with carbon bisulphide at the first signs of infestation.

Russell (T. A.). **An Account of the Palmetto Scale** (*Comstockiella sabalis*).—*Agric. Bull. Bermuda* **13** no. 3 pp. 20–22. Hamilton, March 1934.

Comstockiella sabalis, Comst., the development of which is briefly described, is now distributed on palmetto [*Sabal*] throughout the greater part of Bermuda [*R.A.E.*, A **22** 253]. The scales tend to congregate on the centre of the tree, forming white masses on the spindle and enclosing leaves. The new foliage is attacked as it appears and becomes brown and withered, and the tree sometimes dies. Freshly infested palms in a new area should be immediately destroyed. Spraying with oil emulsion gives a fair degree of control, but it is hoped that in the future natural enemies may be found of value. Two parasites have been introduced into a heavily infested area from localities in which the Coccid appears less numerous.

Pemberton (C. E.). **Notes on the Biology of** *Telenomus nawai* **Ashm., an important Parasite of the Armyworm** *Spodoptera mauritia* **(Boisd.).**—*Hawaii. Plant. Rec.* **37** no. 4 pp. 168–174, 4 figs., 6 refs. Honolulu, 1933. [Recd. April 1934.]

The Scelionid, *Telenomus nawai*, Ashm., is now well established on *Spodoptera mauritia*, Boisd., in the more important of the Hawaiian Islands, to which it was originally introduced accidentally [*R.A.E.*, A **15** 450]. The act of oviposition, the egg and the development of the larva are briefly described. Only one parasite develops in a single host egg [**16** 448]. Females contained 63–84 mature eggs on emergence and laid an average of 89 each during February–March 1928, all within the first few days of adult life. The larva hatches within 2 days and pupates in the host egg after completely consuming the contents. The adults emerge 12–18 days after oviposition, so that the parasite

completes 2½–3 generations to 1 of the host. In captivity, the adults may be kept alive on honey and water for 10–20 days, provided that they are not given access to eggs of *S. mauritia*. Pairing occurs immediately after the emergence of the females, which appear to be slightly more numerous than the males. Parasitism of egg-masses collected from the leaves of sugar-cane and date palm in May 1933 and from the former in December 1927 amounted to over 95 and 98 per cent. respectively. Nearly all the eggs in a batch are quickly attacked when discovered by the parasite, which, however, is slow in following the distribution of its host and may fail to reach suddenly invaded areas.

SIMMONDS (H. W.). *Cremastus* **sp. (?) Parasite of** *Nacoleia octasema*.—*Agric. J. Fiji* **6** no. 2 p. 33. Suva, 1933. [Recd. April 1934.]

By 30th November 1933, 4,479 adults of *Cremastus* sp. had been reared from the original 24 females obtained from Java [*R.A.E.*, A **22** 25], and over 4,000 of these had been released against *Lamprosema* (*Nacoleia*) *octasema*, Meyr. (banana scab moth) in Fiji. Reproduction is parthenogenetic, and though about 6 males were produced, these apparently did not pair. Many colonies have been liberated, and evidence of breeding has been found in the Suva district. A moth apparently identical with *L. octasema* has been reared from the flowers of *Pandanus*.

BELING (I.). **Ueber den Ausflug der Schlupfwespe** *Nemeritis canescens* **Grav. und über die Bedeutung des Geruchssinnes bei der Rückkehr zum Wirt. Zur Biologie von** *Nemeritis canescens* **Grav. (Hym. Ichneum. Ophion.) ii.** [On the Flight of *N. canescens* and the Importance of the Olfactory Sense in the Return to a Host.]—*Biol. Zbl.* **54** no. 3–4 pp. 147–169, 3 figs., 15 refs. Leipzig, 1934.

Marked females of *Nemeritis canescens*, Grav. [*cf. R.A.E.*, A **20** 491] released from the breeding cage flew direct to the window, evidently in order to feed in the open, since they do not feed on their host, *Ephestia kühniella*, Zell., or on the flour in which it lives. A few days later they returned to oviposit, and experiments showed that this return was due to a sense of smell and not to one of direction as in other highly specialised Hymenoptera such as bees. The parasite was most readily attracted to cultures of *Ephestia* in places sheltered from the wind, and was taken in largest numbers in calm weather at midday. One female was recaptured 16 days after release, and others up to 10 days. Adults in the laboratory fed on the nectar of blossoms with flat calyces and on honey-dew on oak leaves. They lived much longer when fed than when given water only [*cf. loc. cit.*]. Moreover, in the stomachs of recaptured insects, drops of a clear sweet liquid were found.

ECKSTEIN (K.). **Zur Biologie des Mehlkäfers** *Tenebrio molitor* **L.** [On the Biology of the Flour Beetle.]—*Mitt. Ges. Vorratsschutz* **10** no. 2 pp. 23–24. Berlin, March 1934.

An unexplained infestation of a house in a forestry district of Brandenburg by *Tenebrio molitor*, L., was observed in 1929. In subsequent experiments, the larvae fed on their own exuviae, the remains of

dead insects and pasted wallpaper, but not on fresh timber, sawdust or shavings. Dust from larval boring was to be seen everywhere in the house, but could not be definitely ascribed to this beetle.

Voigt (G.). **Frühstadien und Frühbekämpfung der Gespinstmotten im Lichte neuerer Arbeiten.** [The early Stages and early Control of Ermine Moths in the Light of recent Publications.]—*Anz. Schädlingsk.* **10** no. 4 pp. 37–42, 6 figs., 19 refs. Berlin, April 1934.

This paper discusses the more important recent literature on *Hyponomeuta* spp. [*R.A.E.*, A **18** 692; **19** 441; **21** 525; etc.], with particular reference to the apple race [*malinellus*, Zell.] of *H. padellus*, L. In Germany, the leaf-mining period of the larvae is from April to June, and picking infested apple leaves in mid-May is an effective control measure.

Beran (F.). **Der Arsengehalt von Futtergras als Folge der Schädlingsbekämpfung.** [The Arsenic Content of Fodder Grass following the Application of an Insecticide.]—*Anz. Schädlingsk.* **10** no. 4 pp. 43–47, 4 figs. Berlin, April 1934.

A detailed account is given of experiments in Austria from which it is concluded that grass in orchards sprayed with 0·1 per cent. Paris green in Bordeaux mixture can be used without danger to cattle 5 weeks or even 3 weeks after spraying, the former being the period required by Austrian law. When the spray was applied direct to the grass at the rate of about $\frac{3}{4}$ pint to 1 sq. yd., the experimental results were similar, but this would not necessarily be safe in practice [*cf. R.A.E.*, A **21** 114].

Friederichs (K.). **Eine Methode zur Untersuchung der Wirkung niedriger Luftfeuchtigkeit auf blattfressende Insekten.** [A Method for investigating the Effect of low Atmospheric Humidity on Leaf-eating Insects.]—*Anz. Schädlingsk.* **10** no. 4 pp. 47–48, 1 fig. Berlin, April 1934.

An apparatus is described for studying the effect on larvae of *Panolis flammea*, Schiff., of low air humidity.

Paoli (G.). **Prodromo di entomologia agraria della Somalia Italiana. Relazione di una missione compiuta al Villaggio Duca degli Abruzzi in collaborazione col Dr. Alfonso Chiaromonte dell' Istituto Agricolo Coloniale Italiano.**—Roy 8vo, 427 pp., 198 figs., 8 pp. refs. Florence, Ist. agric. colon. ital., 1934.

This important volume on the agricultural entomology of Italian Somaliland is based on observations made in 1925 and 1926, mainly by Dr. A. Chiaromonte. It contains chapters on climate (7 pp.), agriculture (4 pp.) and insects and mites of agricultural importance (368 pp.), including beneficial species, a bibliography with page references to the text and indices to the insects and to the plants, seeds and products affected. The distribution and food-plants of most of the species are recorded, with descriptions of the stages and accounts of the biology and the injury done.

Negi (P. S.). **The small red Ant** *Solenopsis geminata* **subsp.** *rufa*, **Jerdon, and its Usefulness to Man.**—*J. Bombay nat. Hist. Soc.* **36** no. 4 pp. 1018–1020, 1 pl., 1 fig. Bombay, 15th December 1933. [Recd. April 1934.]

Solenopsis geminata rufa, Jerd., the workers of which are briefly described, is widely distributed in Bihar & Orissa. Colonies of this ant introduced in baskets or tins with earth from the nest into lac stores will aid in the control of the predators and parasites that attack the lac insect [*Laccifer lacca*, Kerr] [*cf. R.A.E.*, A **18** 385] ; many of these may be killed and others exposed to the ants by scraping all lac that is not to be used as brood soon after its removal from the field. Colonies may also be introduced into fields infested with termites [**19** 650 ; **21** 131], the passages of which should be exposed occasionally by turning over the soil to a depth of two inches and the nests dug up, though where these are abundant and too deep, fumigation would probably be more economic.

Iridomyrmex anceps, Roger, is also effective against enemies of lac, and *Leptogenys* (*Lobopelta*) *processionalis*, Jerd. (*ocellifera*, Roger) is the most important of several other ants attacking termites at Namkum.

Glover (P. M.). **Department of Entomology.**—*Rep. Indian Lac Res. Inst. Namkum, Ranchi, 1932–33* pp. 13–33, 1 pl. Calcutta, 1933. [Recd. April 1934.]

Of the pests attacking the host trees of *Laccifer lacca*, Kerr, in Bihar & Orissa, the Coccid previously recorded on *Schleichera trijuga* and *Zizyphus jujuba* as *Aspidiotus* sp. [*R.A.E.*, A **21** 130] has been identified as *A. orientalis*, Newst. [**22** 165] ; that infesting grapefruit and thought to be the same species is *Aonidiella aurantii*, Mask. The Geometrid, *Semiothisa fidoniata*, Gn., which was abundant on *Acacia catechu* in July–August, was satisfactorily controlled by shaking the trees and collecting the larvae by sweeping a long stick through the threads on which they drop. The soil round the base of the trees was raked over to bury any that had escaped. Hand-picking was the most effective measure against the Pentatomid, *Tessaratoma javanica*, Thnb., a severe outbreak of which occurred on *S. trijuga* during July–August. Larvae of the Limacodids, *Parasa* sp., *Belippa* sp. and *B. laleana*, Moore, were removed from the leaves of *S. trijuga* in November with hand forceps. Slight damage was caused by *B. laleana* to the leaves of the tung oil tree (*Aleurites fordi*), which was introduced to Namkum (Bihar & Orissa) in 1928 and appears to be particularly resistant to insect attack. The decrease in damage by termites is attributed to the systematic fumigation of their nests and to the activities of *Solenopsis geminata rufa*, Jerd. [*cf.* preceding abstract]. Larvae of *Dasychira horsfieldi*, Saund., from eggs found on the stem of *Lantana* on 14th February 1933, hatched in 10 days and fed by preference on *Shorea robusta* (on which they developed most rapidly), but also on the leaves of *Lantana* and *Schleichera trijuga*. Cocoons were first observed among the leaves on 17th March, pupation began on 23rd March, and emergence continued throughout April. This Lymantriid does not appear to be a serious pest. The Coccid reported as *Lecanium* sp. [**19** 650] has been identified as *Coccus* (*L.*) *longulus*, Dougl. ; at Namkum, it attacks *Acacia farnesiana*, *Flemingia congesta*, *Cajanus indicus*, *A. catechu* and *Z. jujuba*, but has not justified the application of control measures.

A parthenogenetic race of *L. lacca* has now been bred through 7 generations. The average numbers of eggs laid by various broods in the four crops are given in a table. The eggs of *Holcocera pulverea*, Meyr. [**20** 575] are laid singly between the cells of lac or in the tests of the females or the empty ones of the males and also on bare twigs, usually those covered with the black fungus growing on the honey-dew secreted by *L. lacca*. The larvae enter the incrustation, in which they tunnel, feeding on the Coccids and their tests, and on the incrustation itself. One larva may destroy as many as 45 adult females or about 450 of the younger stages. As they feed, they leave a tough web of silk interwoven with pieces of incrustation and excreta. They pupate within the galleries in white cocoons. The average adult longevity was highest (15 days for females and 19 for males) in December and lowest (5 days) in May. This Tineid is distributed throughout India. At Namkum, it has 5 generations a year. The first occurs during July–September, and part of the second may emerge in October–November and part hibernate in the larval and pupal stages and appear in March–April. Most of the eggs of the third generation die owing to the cold, but some adults may appear in March–April, those of the fourth emerging in May–June. Eggs of the fifth generation laid in early June are usually killed by the heat, but the survivors and those deposited in late June ultimately give rise to adults in July–August, mainly after the cutting of the lac. The larvae of *H. pulverea* are less injurious in the field than those of *Eublemma amabilis*, Moore [**18** 638] but more important in storage. *E. scitula*, Ramb., is abundant only in southern and western India, where it is a major pest of lac, causing more damage than *E. amabilis* in some districts. At Namkum, it attacks injurious Coccids, but has been bred from *L. lacca* occasionally. At first the young larvae feed within the incrustation, but later they work from the outside under a dome-shaped shell of silk and débris, within which they pupate in cocoons. *Ephestia* sp. emerged in small numbers from stored lac from November 1932 to February 1933, but it was not found in fresh lac from the field. Though it may destroy the larvae of *Eublemma amabilis* [**18** 638 ; **19** 25], it feeds chiefly as a scavenger on the dead lac insects and to some extent also on the resin. Data on the life-history of *E. amabilis* and of this Pyralid are tabulated.

Notes are given on the occurrence of other insects associated with *L. lacca* [**21** 131 ; etc.]. Chalcidoid parasites, which are of less economic importance than predators, destroyed an average of 7·4 per cent. of the cells, and 6 per cent. of them were attacked by hyperparasites. The most important enemy of *E. amabilis* is *Microbracon tachardiae*, Cam. [**19** 25], which parasitises an average of about 6–7 per cent. and a maximum of about 30 per cent. This Braconid has been reared with ease in the laboratory [*cf.* **19** 650] through 20 generations (data on which are tabulated), and the liberation of artificially reared adults in the field at certain times of the year might make it an important factor in control.

RAMAKRISHNA AYYAR (T. V.) & RAMACHANDRAN (S.). **Bees and Beekeeping in South India.**—*Madras agric. J.* **22** no. 2 pp. 58–71, 2 pls., 7 refs. Coimbatore, February 1934.

A popular account is given of the life-history of honey bees. *Apis dorsata*, F., *A. florea*, F., *A. indica*, F. [*cf. R.A.E.*, A **22** 167] and *Melipona* sp. are the only species occurring in South India. Work is

described on the domestication of *A. indica*. The natural enemies include *Philanthus ramakrishnae*, Turner, hornets, *Acherontia styx*, Westw., which feeds on the stored honey, and *Galleria melonella*, L., which often consumes the combs and causes serious damage, especially in weak colonies.

Entomological Investigations on the Spike Disease of Sandal.

Pruthi (H. S.). **(14). Jassidae (Homopt.).**—*Indian For. Rec.* **19** pt. 4, 30 pp., 8 figs., 1 pl. Delhi, 12th February 1934.

Chatterjee (N. C.) & Bose (M.). **(18). Fulgoridae (Homopt.).**—*T.c.* pt. 8, 14 pp., 2 figs. Delhi, 28th February 1934.

These papers belong to a series [*cf. R.A.E.*, A **22** 14, 165], of which numbers 13–18 give further lists of the insects of various families found on sandal (*Santalum album*) in southern India. Jassids the synonomy of which is discussed include *Moonia albimaculata*, Dist. (*variabilis*, Dist. [**20** 373 ; **21** 132, 363]) and *Nephotettix bipunctatus*, F. (*apicalis*, Motsch.). The Issid recorded as *Tatva bufo*, Dist. [**20** 374] has been found to be *Sarima subfasciata*, Melich., and the Flatid recorded as *Melicharia lutescens*, Wlk. [**20** 374] to be *Flata ferrugata*, F.

Species suspected of being vectors of spike disease of sandal are *Moonia albimaculata*, *Acropona walkeri*, Kirk., *Tambinia verticalis*, Dist., *Sarima nigroclypeata*, Melich., *Eurybrachys tomentosa*, F., and the Flatids, *Salurnis marginellus*, Guér., and *F. ferrugata*.

Wilkinson (D. S.). **On two new Braconid Genera from India (Hym.).** —*Stylops* **3** pt. 4 pp. 80–84, 3 figs. London, 14th April 1934.

Descriptions are given of *Cedria paradoxa*, gen. et sp. n., reared from *Hapalia machaeralis*, Wlk., on teak (*Tectona grandis*), *Margaronia* (*Glyphodes*) *pyloalis*, Wlk., and other Pyralids in the United Provinces, and *Sbeitla furax*, gen. et sp. n., probably from insects boring in wood, in India and the Philippines.

Kaburaki (T.). **Habits and Intersexes of *Amphimermis zuimushi* Kabur. et Imam. parasitic in the Rice Borer.** [*In Japanese.*]—*Bot. & Zool.* **2** no. 3 pp. 501–506. Tokyo, March 1934.

The number of *Amphimermis zuimushi*, Kabur. & Imam. [*cf. R.A.E.*, A **20** 495] found in one larva of *Chilo simplex*, Butl., in Japan ranges from 1 to 187. The parasites leave the host (through the ventral skin) from late October to mid-January, but mostly in November, and hibernate in the soil. The eggs are laid from late June to autumn, especially in August, when they hatch in 3 weeks. The young larvae, which can swim and crawl, reach the borers in the rice stems and mature in 2–4 weeks. The host dies soon after the parasites leave.

Yano (M.). **Longicorn Pests of *Paulownia tomentosa*.** [*In Japanese.*] —*Bot. & Zool.* **2** no. 3 pp. 605–606, 1 fig. Tokyo, March 1934.

Larvae of the Prionid, *Megopis sinica*, White, which usually attacks decayed trees, were found in a stem of *Paulownia tomentosa*, the wood of which is used for making tools, having apparently attacked the tree after it had been injured by the Hepialid, *Phassus excrescens*, Butl. The Lamiid, *Batocera lineolata*, Chevr., sometimes injures healthy trees of this species.

Takahashi (R.). **Additions to the Aphid Fauna of Formosa (Hemiptera), II.**—*Philipp. J. Sci.* **52** no. 3 pp. 291–303, 3 figs. Manila, November 1933. [Recd. April 1934.]

Descriptions are given of 12 species of Aphids occurring in Formosa, of which 4 are new. Wingless viviparous females of *Anoecia corni*, F., are recorded from the underground parts of sugar-cane ; in temperate countries, this Aphid passes the winter on *Cornus* and the summer on the roots of grasses [*cf. R.A.E.*, A **17** 321].

Betrem (J. G.). **De takkenboeboek als veroorzaker van takkensterfte** [The Twig-borer as the Cause of the Death of Coffee Twigs.]—*Bergcultures* **8** no. 4 pp. 73–86. Batavia, 1934.

The investigations here described show that much of the mortality of coffee twigs ascribed to twig-borers [*Xyleborus* spp.] in Java is due to other causes, such as lack of water in the soil.

Zeck (E. H.). **White Wax Scale of Citrus** (*Ceroplastes destructor*).—*Agric. Gaz. N.S.W.* **45** pt. 2 pp. 88–90, 1 fig. Sydney, 1st February 1934.

The eggs of *Ceroplastes destructor*, Newst., on *Citrus* and other trees or shrubs in New South Wales [*cf. R.A.E.*, A **20** 601] hatch from December to February, and the crawlers establish themselves along the mid-ribs and veins of the leaves ; they reach maturity and oviposit after about ten months, each female laying about 3,000 eggs. The honey-dew secreted by the Coccids promotes the growth of sooty mould on the leaves, twigs and fruits. Control may be obtained on *Citrus* by spraying with either 15 lb. washing soda or 5½ lb. soda ash (anhydrous sodium carbonate) in 40 gals. water. A more dilute spray (10–12½ lb. washing soda to 40 gals. water) should be used on plants with delicate foliage. The soda should first be dissolved in a little hot water. The optimum time for application is late March, but *Citrus* may be treated satisfactorily as late as mid-May. When the trees are also infested with *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., 1 gal. miscible white oil may be added to 40 gals. spray. The oil should be emulsified in half the water, and then added to the rest in which the soda has already been dissolved. It is inadvisable to apply the combined spray during hot, sunny weather. As the concentration of washing soda is increased by loss of water during storage, soda ash is more reliable.

Nicholls (H. M.). **The Blue Flea-beetle.**—*Tasmanian J. Agric.* (N.S.) **5** no. 1 pp. 18–19. Hobart, 1st February 1934.

Recent damage to the leaves and fruit of strawberries and garden plants in Tasmania was found to be due to *Haltica pagana*, Blkb., which is a well-known pest of strawberries there. This Halticid also attacks the noxious burr, *Acaena sanguisorbae*, which it sometimes eradicates from large areas. The larvae feed more voraciously than the adults. Infestation on garden plants not likely to be used for food can be controlled by a lead arsenate spray. An infusion of 1 oz. hellebore steeped for an hour in 1 gal. water may be used on strawberries, on which the pest usually appears about the time the well-formed fruit is beginning to ripen. Applications may be made to within 1–2 days of harvest.

The only allied beetle that is injurious in Tasmania is *Monolepta subsuturalis*, Blkb., which in the past commonly caused considerable damage in apple orchards by puncturing the fruit. It is now scarce, however, largely owing to the application of lead arsenate and to the removal of native bush from the vicinity of orchards. This Galerucid also occasionally attacks raspberries.

CURRIE (G. A.). **The Bdellid Mite** *Biscirus lapidarius* **Kramer, predatory on the Lucerne Flea** *Sminthurus viridis* **L. in Western Australia.**—*J. Coun. sci. industr. Res. Aust.* **7** no. 1 pp. 9–20, 3 figs. Melbourne, February 1934.

A survey in July and August 1933 revealed the presence of *Biscirus lapidarius*, Kramer, in several localities in Western Australia [*R.A.E.*, A **22** 224] and indicated that it was exercising an effective control of *Smynthurus viridis*, L., on lucerne and other plants. This springtail was the only prey it was observed to attack in the field. Colonisation of any area by the mites apparently originated at or near trees in fields, or by the roadside or rough ground. *Smynthurus* was found sheltering in the same situations. Nearly 15,000 mites were collected by means of an aspirator from under pieces of bark, etc., and especially from trap boards under which they sheltered during showers. Consignments in tubes containing food and plugged with *Sphagnum* wrapped in cellophane were sent successfully to South Australia, Victoria and Tasmania; 90 per cent. were alive on arrival in Victoria, and 300 out of 2,420 in Tasmania. Transport by air was particularly successful. Fair numbers have since been recovered in South Australia and Victoria, and a mite identified as this species has been discovered attacking *Smynthurus viridis* in an area of Tasmania where no liberations were made. In the laboratory, the mites lived for about 9 days at about 65°F. when fed on *S. viridis* or other small Collembola. They could be kept alive in a refrigerator for about 7–12 days without food. They did not feed on eggs of *Smynthurus*.

BALCH (R. E.). **The Balsam Woolly Aphid,** *Adelges piceae* **(Ratz.) in Canada.**—*Sci. Agric.* **14** no. 7 pp. 374–383, 4 figs., 14 refs. Ottawa, March 1934.

The literature on *Chermes* (*Adelges*) *piceae*, Ratz., on *Abies* spp. in Europe and North America is briefly reviewed. The record in this *Review* [A **4** 253] of its occurrence in New Haven, Connecticut, is an error for New Hampshire; it is not known to occur in the former State. The abnormalities produced in the growth of infested trees are discussed, and the life-history is outlined, together with notes on dissemination and control [*cf.* **21** 283]. In New Brunswick, the normal development of the species comprises two generations a year, both consisting of sistentes that settle on the bark. The overwintered forms (hiemosistentes) begin to oviposit on balsam fir (*A. balsamea*) about the middle of May, when the buds are starting to swell. The average number of eggs per female is probably not more than 100. The few progrediens larvae that hatch from the first eggs of the hiemo-sistentes are of two types; some develop into winged adults [**21** 283], and the others, which are found on the new shoots and needles and sometimes on the older growth and also moult four times, remain wingless and lay a few eggs that produce sistentes, some of which are aestivo-sistentes. One typical progrediens larva was found overwintering on the stem of a large tree; when taken

indoors, it developed to the second instar and was evidently of the apterous type. The Agromyzid, *Leucopis obscura*, Hal., has been forwarded from Europe, where it is an important natural enemy of this Aphid [*cf.* **20** 55], by the Imperial Institute of Entomology, and numbers of adults have been liberated in two areas in New Brunswick. Overwintering puparia have since been found in satisfactory numbers.

List of intercepted Plant Pests.—*S.R.A., P.Q.C.A.* [1932] pp. 173–244. Washington, D.C., U.S. Dep. Agric., Plant Quarant. Contr. Admin., December 1932. [Recd. April 1934.]

This list records the pests intercepted on imported plants and plant products in the United States, Hawaii and Porto Rico during the year ending 30th June 1932.

Service and Regulatory Announcements, October–December 1933.—*S.R.A., B.P.Q.*, no. 117 pp. 245–299. Washington, D.C., U.S. Dep. Agric., February 1934.

Recent revisions and amendments to existing quarantine orders of the United States, some of which have already been noticed, are given verbatim. The tenth revision of the quarantine relating to *Popillia japonica*, Newm. (No. 48) brings the States of Maine and West Virginia under restriction and modifies the boundaries in Maryland, New York and Virginia. The inter-State shipment of green maize on the cob, beans in the pod, bananas in entire clusters of 25 or more, apples, peaches or berries from regulated areas is prohibited from 15th June to 15th October except under permit. Commercially packed apples and apples or peaches in shipments of less than 15 lb. are exempt. The shipment of nursery, ornamental and greenhouse stock and all other plants, sand, soil, peat, compost and manure is similarly restricted. A revision of the quarantine relating to *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (No. 52) brings under regulation further parts of Georgia, Texas, Florida and New Mexico, and releases the Salt River Valley of Arizona from restriction.

A press notice in relation to Dutch elm disease, caused by *Graphium ulmi*, states that *Scolytus multistriatus*, Marsh., is the bark-beetle mainly concerned in its local spread [*R.A.E.*, A **22** 34]. This beetle reached the United States several years ago and has been found to be established over an area extending from the vicinity of Philadelphia to eastern Massachusetts.

Plant quarantine restrictions issued by Belgium, Brazil, Argentina, Mexico, England and Wales, and Hungary are quoted or summarised, and a list is given of the current quarantines and other restrictive orders at present in force in the United States, Hawaii and Porto Rico.

Schread (J. C.) & Garman (P.). **Studies on Parasites of the Oriental Fruit Moth. I.** *Trichogramma.*—*Bull. Conn. agric. Exp. Sta.* no. 353 pp. 691–756, 9 figs., 31 refs. New Haven, Conn., June 1933. [Recd. April 1934.]

Work in breeding *Trichogramma* in Connecticut in 1930–32 already noticed [*R.A.E.*, A **21** 334] is here described in greater detail. Various hosts, 11 or more of which have been used by other investigators, were studied or used experimentally, but *Sitotroga cerealella*, Ol., was the only one employed in the experiments described, although it is now

generally thought that hosts laying larger eggs are more desirable. Very few eggs of *S. cerealella* survived exposure for a week to 40–46°F., above which temperature development is possible, but they were satisfactorily parasitised by *Trichogramma* after exposure for 2–3 weeks (at 70–85 per cent. relative humidity). Newly laid eggs withstood refrigeration better than partly developed ones. Temperatures above 85°F. and high relative humidity (70–80 per cent.) during oviposition reduced the percentage of fertile eggs.

The chief enemies of *S. cerealella* are Gamasoid mites, grain beetles (including *Tribolium confusum*, Duv., which became numerous in 1932 in one breeding unit and destroyed much wheat), ants and the larval parasite, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.). Adults and larvae of *Laemophloeus minutus*, Ol. (*pusillus*, Schönh.) attacked the moths and their eggs, and were very abundant and harmful in 1932. The eggs of this Cucujid were sometimes exposed to parasitism by *Trichogramma* in error ; they remained unparasitised, and the larvae on hatching attacked both parasitised and unparasitised eggs of *S. cerealella* and were observed to pull pupae of *Trichogramma* from the host egg and devour them. In 1931, *L. minutus* was kept in check by the Bethylid parasite, *Cephalonomia waterstoni*, Gah. [**19** 495], the adult of which first paralyses and feeds on the grub and then carries it away and buries it.

Details are given of the habits and life-history of *Trichogramma*, the recorded hosts of which in Connecticut include *Pteronus* (*Pteronidea*) *ribesii*, Scop. (currant sawfly), *Alsophila pometaria*, Harr., and *Chrysopa* sp. The maximum number of generations reared in 1931 was 15. Not more than one parasite usually develops in one egg of *S. cerealella* reared on wheat. In the field, two or three often develop in one egg of *P. ribesii* or the oriental fruit moth [*Cydia molesta*, Busck].

Cross-breeding experiments indicate that at least two distinct species of *Trichogramma* occur in Connecticut [*cf.* **18** 369], the yellow species, *T. pretiosum*, Riley, being more commonly encountered than *T. minutum*, Riley. Observations over three years in field and laboratory have shown that *Trichogramma* can complete its development at 49°F. and emerge. In field cages and in the insectary, *T. pretiosum* overwintered in the eggs of *S. cerealella*. From eggs parasitised on 23rd October, adults emerged from 25th November to 2nd May, but of those that emerged before late March not many survived. Polyembryony has not been observed. Unfertilised females deposit eggs that produce only males. Refrigeration has been observed to increase the proportion of males, particularly in the second generation following [*cf.* **19** 558]. Females appear to be less resistant to low temperatures than males. Experiments indicate that 46–47°F. is the best temperature for keeping parasitised eggs of *S. cerealella*. At a constant temperature of 80°F. and 70 per cent. relative humidity, the ratio of females to males was about 2–3 : 1 for *T. pretiosum* and 4–5 : 1 for *T. minutum*. *T. minutum* survived better in eggs of *S. cerealella* at 45–46°F. than in those of *C. molesta*, but better in those of *C. molesta* at 37°F. Wing deformity following 40 days' refrigeration appeared less in *T. minutum* than in *T. pretiosum*, though the latter species generally withstood refrigeration better. The maximum increase under favourable conditions was 1×8–9 and the average 1×4–5. One female may lay as many as 18–29 eggs. *T. minutum* is 50 per cent. more prolific than *T. pretiosum*. The minimum development period of *T. pretiosum* at 80°F. is $6\frac{1}{2}$ days, whereas that of *T. minutum* is $7\frac{1}{4}$ days. In the

laboratory, 88·3 per cent. of the adults died within 24 hours of emergence at 80°F. and 70 per cent. relative humidity, and all within 36 hours. In spring and autumn, adults have lived in the insectary for 20–30 days, and a few were kept alive for about 4 months during autumn and winter.

Previous observations of flight activities [**20** 424] were confirmed in 1932, but the degree of parasitism was lower. Adults liberated at a single point in a peach orchard infested with *C. molesta* dispersed over an area of at least 32,400 sq. ft. in 3 days, apparently unaided by wind. In the laboratory, one female flew 24 feet (to a light) in 2 minutes.

In field and laboratory tests, sulphur sprays or dusts greatly reduced parasitism of *C. molesta* on peach. Talc dust, however, was more injurious than dusts of sulphur, sulphur-lime-lead arsenate, lime or lime-oil-lead arsenate, all of which reduced the percentage of parasitism. Field experiments indicated that liberations of *Trichogramma* raised parasitism and kept it at about 50 per cent., even though frequent sulphur applications were made. It is believed that an interval of a week or 10 days between spraying and liberation will reduce the injurious effect of sulphur to a minimum. In preliminary field observations, parasitism by *Trichogramma* apparently reduced infestation of peach by *C. molesta* but did not give commercial control.

GARMAN (P.) & BRIGHAM (W. T.). **Studies on Parasites of the Oriental Fruit Moth. II.** *Macrocentrus ancylivorus.—Bull. Conn. agric. Exp. Sta.* no. 356 pp. 73–116, 12 figs., 14 refs. New Haven, Conn., December 1933. [Recd. April 1934.]

A short account of the rearing of *Cydia* (*Grapholitha*) *molesta*, Busck, and its parasite, *Macrocentrus ancylivora*, Roh., in Connecticut from 1929 to 1933 has already been noticed [*R.A.E.*, A **21** 329]. The chief enemies encountered in rearing the host were spiders, ants and fruit rots. *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), which attacks the larva of *M. ancylivora* after it has spun its cocoon within that of the host, caused considerable trouble in 1932; it will also parasitise *C. molesta*, but prefers *Macrocentrus*.

In 1932, the average mortality of larvae of *C. molesta* reared in apples and kept in the refrigerator throughout the winter was 65 per cent., moisture being the chief cause. Larvae placed in a refrigerator in April and removed in September showed only 10 per cent. mortality. In 1933, mortality was much lower among larvae reared in pans and hibernating in the open insectary than among those reared indoors and hibernating in the storage cellar. Exposure to low temperatures (38–40 or 45–50°F) of larvae 4 or 6 days old, especially those of the brood hatching in August, increased the percentage that entered hibernation, but refrigeration of the eggs or parent moths for some weeks did not affect it. Maximum egg-production took place in incubators where light was provided from above and where the temperature was kept about 80°F., especially at sunset, when a fall in temperature greatly reduced oviposition. The rate of increase for the entire breeding period averaged 1×17, or 24 for moths that had not been refrigerated, with a maximum of 30. The sex ratio was about 1 : 1.

Other recorded hosts of *M. ancylivora* in the United States are: *Ancylis comptana*, Fröl., *Epiblema strenuana*, Wlk., *Canarsia* sp.,

Epagoge sp., *Cydia* (*Carpocapsa*) *pomonella*, L., and *Argyroploce* (*Exartema*) *sericorana*, Wlsm., which occurs in Connecticut and may possibly serve as an alternative host when *C. molesta* is scarce or inaccessible. As *M. ancylivora* was collected before the introduction of *C. molesta* into the United States, it is evidently a native species.

M. ancylivora overwinters as a first-instar larva within a hibernating caterpillar. Adult emergence, which begins a little later than that of *C. molesta*, lasted in 1933 from 28th May to 21st June. Larvae of *C. molesta* are usually available in considerable numbers in June and July, and by August 80–100 per cent. of those feeding in peach twigs [*cf.* **20** 647] may be parasitised. Three broods may develop in Connecticut, and adults are present in the field almost continuously from 1st June. In the laboratory in 1932, adults of the three generations emerged respectively from 6th to 23rd July, from 1st August to 5th September and from 1st September to 15th November. There was no autumn emergence from larvae parasitised after 1st September, and some adults from larvae parasitised in August emerged in June 1933. The average development period in 1932 was 33 days in June, 29 in July, 38 in August and 70 in September, the range being 19–88 days. The pre-oviposition period of 1–4 days brings the total life-cycle at midsummer to 30–33 days. The life-cycle is very similar to that of *C. molesta*, the chief deviation being the more prolonged period of adult emergence of the parasite. In general, it is shorter than that of the host.

Although oviposition occurs at midsummer mainly in the late afternoon and at night, during cooler weather it may occur throughout the day and is much reduced in the morning and evening. It was continuous in indoor cages if temperature, light and humidity were suitably adjusted. No entirely satisfactory method was devised for inducing host larvae to enter hibernating quarters before the parasite develops beyond the first instar and at a temperature permitting all the eggs of the latter to hatch [*cf.* **21** 329 ; **22** 178]. A female continues to oviposit under favourable conditions for 18 days, with an average of 12. The rate of increase averaged 1×15, but as many as 50 adults have been obtained from one female. In the field, about 41 per cent. were males ; in the laboratory, however, this percentage increased during the summer, often to 75 or more, except among the offspring of females that had been caged with an excess (2–3 : 1) of males. Hibernation does not affect sex ratio or rate of increase.

The number of host eggs used was in 1931 about 14 times that of the adult parasites produced, which from 1930 to 1933 totalled 112,983, 12,000 being liberated in orchards during 1932 and 1933. A higher percentage of larvae were parasitised in peach twigs than in green apples [*cf.* **22** 178], although 76 per cent. parasitism has been obtained in apple slices. Parasitism of 40–50 per cent., which is adequate for mass breeding, was obtained during the winter of 1932 in apple slices. Sulphur dust applied to the foliage shortened the life of *Macrocentrus* in cages.

In field collections carried out in New Jersey over two years, 20,000 parasites were obtained and liberated in peach orchards. Field studies of *Macrocentrus* indicate that it will live from year to year in the same orchard and that its presence is correlated with general reduction of fruit infestation when the parasitism of the second-brood larvae of *C. molesta* is high. In two of the orchards under observation, it required three years to bring about the desired parasitism ; in another, parasitism developed more rapidly.

DITMAN (L. P.) & CORY (E. N.). **Corn Earworm Studies.**—*Bull. Md agric. Exp. Sta.* no. 348 pp. 525–543, 6 graphs, 9 refs. College Park, Md, May 1933. [Recd. April 1934.]

The results are given of further investigations on *Heliothis obsoleta*, F., on maize in Maryland [*cf. R.A.E.*, A **19** 633]. The pre-oviposition period was 3–5 days, the incubation period 3–10 days, and the larval 2–3 weeks. The pupal period, in cells at a depth of 1–10 inches in the soil, lasted 10–14 days or more. Injury was less severe in ears with long, tight husks, as proved by detailed observations, and apparently also in varieties with narrow grains. Moths 1–2 days old liberated in a dark-room were at first most attracted to light of short wave length (0·25–0·40+μ), but after 3–4 hours to light of longer wave length (0·39–0·72μ). As the experiment proceeded, an increasing number of moths retreated to darker parts of the room and failed to respond further. At room temperature, moths that were fed daily on water alone lived an average of 11·7 days, those fed on invert sugar solution (containing cane sugar) 16·9, those fed on glucose solution 14·8, and unfed moths 7·6. Large moths lived longer than small ones. Reference is made to the relative attractiveness of various sugar solutions [**21** 238]. Larvae that fed on maize in the dough stage stored less saturated fat than those that fed on maize in the milk stage or on beans or tomatos. Fats stored by larvae feeding at high temperatures tended to be less saturated than those stored at low temperatures

Of four fields observed, the two that had been ploughed in autumn and planted with a cover crop yielded no live pupae, but the actual effectiveness of this measure is difficult to estimate. Cresol, Dippel's oil and chloronaphthalene used in dusts with either talc or lime were of no value as repellents against ovipositing moths.

Various baits were tested in the field in pails; these only catch a few of the moths attracted, but serve to show the relative, though not the actual, attractiveness of the baits. In preliminary tests, malt syrup proved the most effective for Lepidoptera in general, but was expensive. As a result of experiments with different combinations and concentrations of sugars and syrups, a fermenting mixture of 2,000 cc. water, 2,000 gm. each of cane sugar and cerelose, and 900 cc. malt syrup gave the best results both for *Heliothis* and for other Lepidoptera. The ratio of other Lepidoptera to *H. obsoleta* was considerably higher in a fermenting bait than in a non-fermenting one. There was a large increase in the number of moths of this species late in the summer. Baits were more effective on the edge of the field, and when there was an abundance of yeast, owing to the pail having been previously used for a fermenting bait, the catches were usually greatest on the third day. The baits lasted longer at low temperatures.

DAVIS (E. G.) & others. **The Southwestern Corn Borer.**—*Tech. Bull. U.S. Dep. Agric.* no. 388, 61 pp., 28 figs., 13 refs. Washington, D.C., December 1933. [Recd. April 1934.]

Apart from periodic outbreaks, injury to maize by *Diatraea grandiosella*, Dyar, in normal years is greater than is generally realised. All stages of this Pyralid are described. It occurs in Mexico and in Arizona, New Mexico, Texas, Oklahoma, Colorado and Kansas. It has been spreading northwards, mainly by the flight of the moths along river

valleys. The present area of infestation in the United States does not overlap with that of any other species of *Diatraea*. The known food-plants include *Sorghum* and sugar-cane, although maize is usually the only crop materially damaged. In Tucson, Arizona, which has an elevation of 2,387 ft. and is exceptionally arid, the combined effect of larval attack on the leaves, buds and stalks and occasionally the ears sometimes leads even to total destruction of the maize crop, though infestation of grain sorghums has not amounted to more than 10 per cent. of stalks.

The larvae overwinter, usually at the bottom of the main root. Their pupal period extends over about 6 weeks. The adults, which are nocturnal in habit, emerge in south-western Arizona from the first part of May to early June, and rather later in north-eastern New Mexico. Slight emergence may continue in some seasons until July. Oviposition normally begins 48 hours after emergence and continues in southern Arizona from the first third of May until the first week of June. Most of the eggs have usually been deposited, both there and in New Mexico, by 25th May. The larvae of the first generation occur from May to July and are most numerous during the first half of June, pupating in southern Arizona in June or July and in north-eastern New Mexico in late July or early August. Emergence of the adults continues from about 20th June to the end of July in Arizona, and from the last third of July until the third week of August in New Mexico. In Arizona, eggs of the second generation have become scarce by early August. Larvae appear about the end of June, and in late August and early September some of them enter winter quarters in the maize stubs. By the end of October, practically all have done so, but some pupate in July or August and give rise to a partial third generation in August. Very few third-brood eggs, however, have been observed to hatch, owing to parasitism by *Trichogramma minutum*, Riley. A survey of maize fields in 1928 showed that over 90 per cent. of them had been parasitised. A large proportion of the larvae hatching from those that escaped parasitism failed to mature, but a few survived the winter. In north-eastern New Mexico, a large proportion of the larvae attain full growth and prepare their winter quarters by the last week in September. Those that are then half-grown (about 7–15 per cent.) and occur in the upper part of the stalks, mostly fail to complete their growth. A very small number pupate at the end of September, but do not survive. In Arizona, development was much slower in spring and summer at an altitude of 4,000 ft. than at 2,000 ft., and the second-brood larvae entered hibernation 1–2 weeks earlier.

One female lays from 150 to 400 eggs, mostly on the upper surface of the leaves. The larvae hatch in about 5 days ; at first they tunnel in the mid-rib of the larger leaves or feed for a while nearer the place where the eggs were laid, but later they work towards the rolled leaves or bud. In the third or fourth instar, they leave the bud and enter the stalk, generally in the lower part. Usually not more than one larva survives the winter in a single stalk. Mortality during hibernation ranged from 5 to 100 per cent., being greater in New Mexico than in Arizona. Borers have been found to measure 15 per cent. less in spring than in autumn, owing to loss of adipose tissue during the winter. Infestation is reduced in summer by rain accompanied by wind, which washes many of the eggs off the plants, and water in the heart of curled leaves drowns the young larvae feeding there. Small larvae of the partial

third generation are unable to feed on the tough and fibrous plants of late summer and die of starvation.

By far the most effective parasite is *T. minutum*, of which 3–4 eggs are generally laid in one host egg. The parasite is very scarce during the emergence of the overwintered generation, but increases during the oviposition period of the first generation, and by that of the second generation becomes very numerous. Its life-cycle at Tucson from oviposition to adult emergence ranged from 6 to 10 days. During the most active season (May-September), it has approximately 19 generations. In north-eastern New Mexico, parasitism by *Trichogramma* is low. *Prospaltella* sp. and *Telenomus* sp. have been reared from the eggs of *D. grandiosella*, and the former also from *Heliothis obsoleta*, F., which is often associated with it on maize. The larval parasite, *Apanteles diatraeae*, Mues., is an important factor in control. Cage experiments indicated that it parasitises the young larvae of *D. grandiosella* before they conceal themselves in the food-plant. The full-grown parasite larvae emerge and spin cocoons. Very few borers of the first generation are parasitised in June, but the percentage of larvae attacked increases during the second generation and reaches its maximum in August; at this period in 1928, 20 per cent. had been parasitised in Tucson. Insect predators are *Solenopsis geminata* var. *diabola*, Wheeler, which preys on the larvae, pupae and adults, sometimes destroying 75 per cent., and *Reticulitermes humilis*, Banks, which destroys a small proportion of the winter larvae. Many dead larvae, particularly of the winter form, are infected with the fungus, *Isaria barbari*, and some larvae that had died in the stubble during the winter were covered with a reddish fungus, *Fusarium* sp.

Autumn ploughing followed by thorough disking and harrowing, so as to crack unburied stubble and free it of soil, has been found to destroy almost all the overwintering larvae. Autumn cultivation is not recommended, however, where there is danger of soil blowing. Field maize should be planted as late as practicable in May or early June to avoid infestation by the first generation. In sandy soils, autumn listing should be practised with a view to turning the stubble or stalks to the surface, but this should be followed by counterlisting in spring to prevent the soil from blowing. Old maize stubs should not be allowed to remain piled about the farm, and alternative food-plants should be destroyed. The value of insecticides for controlling *D. grandiosella* has not been fully determined, but barium fluosilicate, diluted 1 : 2 with hydrated lime or other carrier, has shown some promise. A plot dusted with a commercial product containing 80 per cent. barium fluosilicate had only 3 per cent. of the maize stalks infested as compared with 47 per cent. in the check plot. The results of sprays were not promising, though miscible oil gave fair results against the eggs after 3 applications.

[**Insect Pests in New Mexico in 1932–33.**]—*Rep. New Mexico agric. Exp. Sta.* **44** (1932–33) pp. 36–44, 56–58, 2 figs., 1 pl. State College, N.M. [1934.]

In addition to field experiments [*cf. R.A.E.*, A **21** 79, 449], tests were carried out in New Mexico in a dark room at 70°F. on the reaction to various baits and lights of batches of 50 newly emerged adults of the codling moth [*Cydia pomonella*, L.]. The order of attractiveness of the baits was : iso-butyl phenyl acetate ; cane syrup ; ethyl oxyhydrate [but *cf.* **21** 450] ; geranyl formate. That of the lights was : white

light ; mercury vapour ; violet light ; green light. Red light was not attractive. The percentages trapped at different hours in August were : 60–70 between sunset and twilight ; 10 during the darker hours ; and 15–20 at sunrise. A mercury vapour tube (0·026–0·03 foot-candle capacity) was slightly more effective than ordinary electric lamps, the best of which were 75 and 100 watt lamps of 3 and 5 foot-candle intensity respectively. A higher intensity was repellent. The best control on apples was obtained by 6 applications of lead arsenate (3 lb. to 100 U.S. gals.), especially when 1 U.S. gal. Volck oil or 6 lb. Ferroskim was added to the last three. Various substitutes, including 3 lb. Kaolith (sodium aluminium fluosilicate) with 6 lb. Ferroskim, tested in the last three sprays gave inferior results.

Sprays of Bordeaux mixture (5 : 5 : 50), alone or with 1 gal. Volck oil and 1 pint nicotine sulphate to 100 gals. or with 1 pint rotenone extract, applied against the potato Psyllid [*Paratrioza cockerelli*, Sulč] noticeably increased the yield of potatoes.

An extensive outbreak of *Euxoa inconcinna*, Harvey, *Mamestra lilacina*, Harvey, and *Chorizagrotis auxiliaris* f. *introferens*, Grote, the first being the most abundant, occurred on lucerne and garden vegetables in the spring. Of the baits tested, Paris green and chopped lucerne leaves was the most effective. Larvae in cages were subjected to flooding as in ordinary irrigation methods, and the mortality increased with the length of immersion from 40 per cent. after 4 hours to 95 after 50. Larvae washed to the borders, however, dried off rapidly and recovered.

Corrugated paper bands treated with alpha and beta naphthol successfully protected apple trees against the giant apple root borer [*Prionus californicus*, Motsch.] as did paradichlorobenzene [*cf.* **16** 681]. The adults appeared late (18th June–15th July), so that protection of the bases of the trees was continued until 30th July against late hatching larvae.

PLATH (O. E.). **Bumblebees and their Ways.**—Demy 8vo, xvi+201 pp., 11 pls., 20 figs., 18 pp. refs. New York, The Macmillan Company, 1934. Price 17*s*.

This account of the habits of the bumble-bees occurring in New England and other parts of North America is based on investigations carried out during 13 consecutive summers. The foundation and development of the colony is described, with chapters on the methods adopted for its protection from unfavourable conditions or other insects, which are themselves discussed. One chapter is devoted to the economic importance of these bees in the pollination of red clover, purple vetch (*Vicia cracca*) and *Delphinium*. Descriptions are given of the technique employed in their study and of a classification based on their behaviour. Notes are appended on the appearance and bionomics of the 13 common species of *Bombus* and the 4 of *Psithyrus*, the latter being parasitic in the nests of the former.

DOWDEN (P. B.). *Zenillia libatrix* **Panzer, a Tachinid Parasite of the Gypsy Moth and the Brown-tail Moth.**—*J. agric. Res.* **48** no. 2 pp. 97–114, 4 figs., 18 refs. Washington, D.C., 15th January 1934. [Recd. April 1934.]

Zenillia libatrix, Panz., all stages of which are described, is a common and widely distributed European parasite of *Porthetria dispar*,

L., *Nygmia phaeorrhoea*, Don., *Stilpnotia salicis*, L., and other Lepidoptera, a list of which is given from the literature and from rearings in Hungary. It is usually of little importance in control. In Massachusetts, a summer generation was successfully reared in the native moths, *Euchaetias egle*, Drury, and *Pygaera* (*Melalopha*) *inclusa*, Hb., and in the latter the Tachinid also overwintered. In Hungary, flies that have overwintered in the larval stage within host pupae emerge in April or May. The first generation develops in *Porthetria dispar* or some other host present from mid-May to early July, the adults emerging in July or August. There may be a partial third generation. Pairing occurs at 64·4–77°F., the females pairing only once and the males possibly as many as 8 times. The fly deposits an average of 1,820 eggs on leaves of almost any type, usually along the margins, where they are eaten by the host caterpillars. They remain viable for 15 days. The larvae hatch shortly after the eggs are consumed and enter the abdominal muscles, the silk glands or occasionally a histoblast, where they develop slowly until the host pupates. They then migrate to the anterior portion of the host, form an integumental breathing funnel and rapidly complete their development. The pupal period (13–14 days for males and 14–15 for females) is usually passed in the soil but occasionally inside the host pupa. As many as five maggots may complete development in a single larva of *P. dispar*, but only one usually does so. The effectiveness of the Tachinid appears to be limited by its wide host-range, the appearance of a second generation in autumn when few host larvae are available, and the length of the larval period. Small numbers have been released in New England intermittently since 1906, but it is not known to be established.

Fleming (W. E.). **Development of a standard Cage Method for testing the Effectiveness of Stomach-poison Insecticides on the Japanese Beetle.**—*J. agric. Res.* **48** no. 2 pp. 115–130, 7 figs., 13 refs. Washington, D.C., 15th January 1934. [Recd. April 1934.]

Tests in New Jersey of stomach poisons against *Popillia japonica*, Newm., in wire cages [*R.A.E.*, A **15** 627 ; **16** 119] have proved unsatisfactory owing to variation in temperature, humidity and light and to the fact that the beetles spend a large part of the time on the wire of the cage attempting to escape. A special cage with a wooden frame was therefore evolved in 1932, having the top of glass and the sides of strips of glass 1½ inches wide spaced $\frac{1}{16}$ inch apart. It rests on a base covered with 8-mesh wire, in which are cut circular holes to receive potted plants standing in water. As it is practically impossible for the beetles to cling to the glass, they congregate on the foliage. The optimum conditions for experiments were a temperature of 85–90°F., a relative humidity of 90–95 per cent. and illumination by a yellow light of an intensity of 85 candle-meters. A batch of 200 beetles was a convenient unit. Under these controlled conditions, the differences between maximum and minimum mortalities were generally much reduced. A spray of acid lead arsenate (2–8 lb. to 100 U.S. gals.) killed about 80–90 per cent. in 48 hours. The higher concentrations acted more rapidly, but their ultimate toxicity is probably the same.

Hartzell (F. Z.). **Tar Distillate Emulsions for Rosy Aphid Control.**—*Proc. N. Y. St. hort. Soc.* **79** pp. 15–24. Le Roy, N.Y., 1934.

As the delayed dormant applications of lime-sulphur and nicotine sulphate applied against the rosy apple aphis [*Anuraphis roseus*,

Baker] in New York also help to control the bud moth [*Eucosma ocellana*, Schiff.] [*R.A.E.*, A **20** 219], substitutes such as cresylic acid that are ineffective against this Tortricid should not be used. Cresylic acid (½ gal. with 3 gals. lubricating oil in 100 gals.), though effective against Aphid eggs and able to be applied in windy weather, is on the whole inferior to nicotine and in practice no cheaper, besides being liable to scorch apple buds [*cf.* **20** 81, 83].

Various tar distillate oils have also been tested against apple pests [**22** 179]. The method of obtaining them from coal tar is described. The fractions that distil from 200°C. upwards are known in America as crude creosote oil and in Europe as tar distillates. The refined creosote oil used in tar distillate emulsions is obtained by removing the fractions that distil above 360°C. The necessary specifications for a refined creosote oil for spraying are enumerated. Most of the proprietary tar oil washes tested also contained lubricating oil, about 80 per cent. being active ingredients (55–58 per cent. creosote oil, 2–9 per cent. tar acids, 15–23 per cent. lubricating oil and 17–20 per cent. water and emulsifying agents). The dilutions used varied from 2 to 12 per cent. of the stock emulsion. Tar acids decreased the toxicity of the emulsions. Creosote oil was the active ingredient destroying Aphid eggs, *E. ocellana*, oyster-shell scale [*Lepidosaphes ulmi*, L.] and probably scurfy scale [*Chionaspis furfura*, Fitch]. The addition of petroleum (lubricating) oil proved effective against San José scale [*Aspidiotus perniciosus*, Comst.] and the eggs of the fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.].

A total oil content of 6 per cent. in the spray mixture was usually the maximum for safe spraying under New York conditions [*cf.* **20** 520; **22** 179], whether it was creosote or lubricating oil alone or a mixture of both. A table of dilutions for proprietary tar distillates is given for use against several apple pests [*cf.* **22** 179]. These emulsions may be used instead of, or as a supplement to, lime-sulphur and nicotine.

EBELING (W.). **A new predacious Mite from southern California (Acarina, Erythraeidae).**—*Pan-Pacif. Ent.* **10** no. 1 pp. 33–34, 1 fig. San Francisco, Calif., January 1934. [Recd. April 1934.]

Erythraeus aonidiphagus, sp. n., is described from *Citrus* in California. As many as 30 of the mites, but generally not more than 1–2, were found on one tree. It attacks mites of its own and other species, small insects and the red scale [*Aonidiella aurantii*, Mask.], of which last it might be an important enemy if it were more abundant. The characters distinguishing *E. aonidiphagus* from *E. moestus*, Banks, and *E. posticatus*, Banks, both of which also occur on *Citrus* in California, are briefly given.

ESSIG (E. O.). **Note on the Alder Scale.**—*Pan-Pacif. Ent.* **10** no. 1 p. 44. San Francisco, Calif., January 1934. [Recd. April 1934.]

A Coccid that appears to be *Xylococculus* (*Xylococcus*) *betulae*, Perg., has been taken a number of times recently on prune trees in the Santa Clara Valley, California. This seems to be the first record of a scale of this type on fruit trees. It occurs normally on elder and birch in Oregon and California and is common in the eastern States. Its presence is indicated by a slender, white thread that protrudes, usually from a crotch in a small branch or at the base of a leaf-bud, the female being embedded in the tissues.

Basinger (A. J.). **Reproduction in Mealybugs.**—*Ann. ent. Soc. Amer.* **27** no. 1 pp. 17–20, 2 refs. Columbus, Ohio, March 1934.

An account is given of experiments in 1931 and 1932 showing that neither *Pseudococcus gahani*, Green, nor *Phenacoccus gossypii*, Tns. & Ckll., can reproduce parthenogenetically and that both sexes of either species occur in approximately equal numbers.

Parish (H. E.). **Biology of** *Euschistus variolarius* **P. De B.**—*Ann. ent. Soc. Amer.* **27** no. 1 pp. 50–54, 13 refs. Columbus, Ohio, March 1934.

All stages of *Euschistus variolarius*, P. de B., which are described, have been taken in Iowa on maize, wheat, tomatos, beans, ground-cherries [*Physalis*] and mullein [*Verbascum*]. This Pentatomid is seldom found south of 37° N. Lat. The adults hibernate by preference in beds of dry leaves, or under leaves of mullein, logs or dead grass in fence rows. The percentage mortality of bugs covered with snow and with dry grass in fence rows was 100 and 84, respectively ; of those in pine forests or in oak leaves with a north exposure, it was 80, and of those in oak leaves with a south exposure, 68. Activity was markedly decreased at 21–19°C. [69·8–66·2°F.] and ceased at 16°C. [60·8°F.] ; no movement of any kind occurred below 11°C. [51·8°F.]. In the greenhouse, however, rearing was carried on continuously throughout the year. In the field, the eggs are laid in clusters of 1–32 on the lower surface of the leaves. The nymphs and adults show a marked preference for the tender shoots of succulent plants and are seldom observed, as they feed and rest in inconspicuous places. Under laboratory conditions, the incubation period averaged 6 days, the nymphal period 50·2, the period before pairing about 24·5, and that between pairing and oviposition 27. There is one generation annually in the field. In confinement, the nymphs and adults consumed the eggs, but did not attack other insects. Overwintering adults were parasitised by the Tachinids, *Gymnosoma fuliginosum*, R.-D., *Cistogaster immaculatus*, Macq., and *Trichopoda pennipes*, F., which last was the most numerous, killing 3·8 per cent. of bugs collected in the spring of 1929.

Rohwer (S. A.). **Descriptions of five parasitic Hymenoptera.**—*Proc. ent. Soc. Wash.* **36** no. 2 pp. 43–48, 1 ref. Washington, D.C., February 1934.

The new species described are : the Pteromalids, *Bruchobius magnus* from *Bruchus pisorum*, L., *B. rufimanus*, Boh., and *B. cicatricosus*, Fhs., in South Africa, and *Catolaccus fragariae* from *Anthonomus signatus*, Say, in Tennessee ; and the Braconids, *Phanerotoma formosana* from *Margaronia* (*Glyphodes*) *pyloalis*, Wlk., *Rhogas narangae* from *Naranga aenescens*, Moore, and *R. metanastriae*, apparently from *Dendrolimus* (*Metanastria*) *punctatus*, Wlk., all in Formosa.

Richardson (H. H.). [**Experiments on the Control of** *Phenacoccus gossypii* **in the United States.**]—*Proc. ent. Soc. Wash.* **36** no. 2 p. 49. Washington, D.C., February 1934.

Phenacoccus gossypii, Tns. & Ckll., which is widely distributed over the United States, has recently become increasingly injurious on greenhouse plants, particularly *Chrysanthemum*. A 10 per cent. kerosene

emulsion was the most effective of 16 sprays, but fumigation overnight with $\frac{3}{8}$–$\frac{1}{2}$ oz. calcium cyanide to 1,000 cu. ft. gave the most satisfactory control, resulting in a high mortality of all stages except the eggs and causing no injury to *Chrysanthemum* in any stage of bloom. This mealybug appears to be more susceptible to hydrocyanic acid gas than some others present in greenhouses.

McAlister, jr. (L. C.). [**Fruit-flies occurring on the Island of Key West, Florida.**]—*Proc. ent. Soc. Wash.* **36** no. 2 p. 49. Washington, D.C., February 1934.

Infestation by the West Indian fruit-fly [*Anastrepha acidusa*, Wlk., previously identified as *A. fraterculus*, Wied.] was heavy in 1932 throughout the island of Key West, where it was discovered infesting hog-plums (*Spondias mombin*) in 1930 [*R.A.E.*, A **21** 226]. Investigations on *A. acidusa* and *A. suspensa*, Lw., which also occurs on the Island, showed that the former may oviposit in 35 different fruits (including grapefruit), many of which may also be attacked by the latter. The superiority of tartar emetic as a bait-spray was confirmed.

Tucker (R. W. E.). **Rate of Egg Deposition of *Diatraea saccharalis* and Extent of Larval Mortality in Canefields and their Relation to Control of *Diatraea* by *Trichogramma minutum*.**—*Agric. J. Dep. Sci. Agric. Barbados* **2** no. 4 pp. 33–52, 2 refs. [Bridgetown] October 1933. [Recd. April 1934.]

An area in Barbados of $\frac{1}{4}$–$\frac{1}{3}$ acre was planted with sugar-cane in November 1932, artificially infested with *Diatraea saccharalis*, F., in January–February 1933 and examined twice weekly until December; one of the 12 plots into which it was divided was reaped each month. The results show the number of eggs laid in each plot per month, the percentage attacked by natural enemies and the early and total larval mortality

The following is largely taken from the author's summary: A maximum of 27,000–28,000 and a minimum of 2,500 eggs were laid per acre, 15 per cent. being added to allow for field errors. Contrary to usual experience, the rate of deposition decreased from March onwards. The conditions each month in fields selected at random confirmed these findings. An Erythraeid, *Atomus* sp., and the larvae of a Psocid attacked egg-masses of all ages, including those parasitised by *Trichogramma* [*minutum*, Riley], though the mite prefers to suck eggs that have been newly laid. Eggs that have been attacked by these predators may easily be mistaken for hatched ones. Early in the year they cause greater mortality than *Trichogramma*, though this parasite finally predominates, particularly where liberations have been made [*cf. R.A.E.*, A **20** 402]. Early larval mortality exceeds 90 per cent. early in the year only, when cane growth is sparse; when the stools are well developed and the fields present a uniform slightly interlocking growth of 3–5 ft. in height, the survival rate may reach even 100 per cent. The author considers that much adverse criticism of the effectiveness of liberating *Trichogramma* against *Diatraea* [*cf.* **21** 543; etc.] is due to over-estimation of the numbers of host eggs per acre, of the larvae that eventually hatch and the proportion of these that dies, and of

the natural abundance of the parasite. *Trichogramma* correctly used has proved effective against *Diatraea* in sugar-cane in Barbados, Louisiana [**21** 225] and Peru [**21** 597].

Tucker (R. W. E.). **Varietal Factors in Cane which may influence Extent of Oviposition by** *D. saccharalis* **and a possible Method for determining Varietal Susceptibility to Borer Attack.**—*Agric. J. Dep. Sci. Agric. Barbados* **2** no. 4 pp. 53–59, 2 refs. [Bridgetown] October 1933. [Recd. April 1934.]

Varietal susceptibility of sugar-cane to infestation by *Diatraea saccharalis*, F., may be influenced by the strength of an odour possibly attractive to the adults, the suitability of the leaves for oviposition, or the degree of resistance of the plant to the entry and feeding of the larvae. The determination of the first two factors is at present impossible. It appears, however, that the newly-hatched larvae are more likely to survive when the percentage of dry matter in the central spike is low and presumably when the plant tissues as a whole are soft. A high percentage of dry matter in the leaf spindle should therefore be considered a desirable quality to select.

Squire (F. A.). **Report of the Entomological Division for the Year 1932.**—*Div. Rep. Dep. Agric. Brit. Guiana 1932* pp. 133–140. Georgetown, 1934.

The larvae of *Dyscinetus geminatus*, F., and *D. bidentatus*, Burm., on sugar-cane in British Guiana [*cf. R.A.E.*, A **21** 615] were attacked by those of the Asilid, *Mallophora calida*, F. *Sipha flava*, Forbes, became abundant on sugar-cane during 1932, but the Coccinellids, *Ceratomegilla* (*Megilla*) *maculata*, DeG., and *Cycloneda* (*Neda*) *sanguinea*, L., and the Syrphid, *Ocyptamus dimidiatus*, F., reduced its numbers. *Pitangus* (*Tyrannus*) *sulphuratus*, a protected bird, fed on these predators.

Experiments are described with *Calandra oryzae*, L. [**22** 136]. Re-threshing the rice, in order to destroy infested grains, reduced infestation from 1·5 to 0·6 per cent., the maximum allowed for export being 1·0 per cent.

Brassolis sophorae, L., was not abundant on coconut in 1932. *Strategus aloeus*, L., which bores in the base of the stems of young coconut trees, can be controlled by inserting a piece of calcium carbide into the hole to drive out the beetle, which can then be destroyed. The Limacodid, *Camila fusca*, Stoll, caused considerable damage to *Citrus* and ornamental palms. The Scelionid, *Hadronotus rugosithorax*, Ashm., was bred from the eggs of *Athaumastus laetus*, Mayr, a Coreid pest of pineapples ; not more than one parasite was found in each egg and the life-cycle was 12 days. *Solenopsis* sp., fostering mealybugs (*Pseudococcus* sp.), possibly retards the growth of pineapple by constructing extensive shelters round the plants. The mealybugs, which are found in small numbers between the leaves near the base of the plant, are apparently not injurious. Extracts of the bark, stem and leaves of haiari [*Lonchocarpus* sp.] made with cold or hot water or with carbon tetrachloride were used in sprays against the ant without effect. Sprays of haiari are, however, reported to have given good results against an ant (? *Prenolepis* sp.) on coffee in north-western British Guiana.

ZOLOTAREVSKY (B. N.) & DE LÉPINEY (J.). **Note préliminaire sur *Schistocerca gregaria* Forsk. dans le Nord-Ouest du Soudan français.** —*Bull. Soc. Hist. nat. Afr. N.* **25** no. 2 pp. 61–70, 2 refs. Algiers, February 1934.

Egg-laying swarms of *Schistocerca gregaria*, Forsk., appeared in the Nema district of the French Sudan from the north at the end of July 1933, and their progeny reached the adult stage in the second half of September. The hoppers were mostly of ph. *gregaria*, but tended to assume *dissocians* characters, and the resulting adults dispersed. The rare pure-green hoppers changed to ph. *congregans*; albino hoppers were observed, but were weak and did not complete their development.

A local population of solitary adults was also discovered, obviously surviving since the previous rainy season (June–September 1932). They were grey-coloured and their hoppers were green, while the morphological characters of the new adults were more markedly *solitaria* than those of the parents. The hoppers were very inactive and, when overtaken by a band of gregarious hoppers, did not join in the mass movement, but tried to escape. The adults of both generations were also very inactive, but reacted strongly to the appearance of man and animals, flying for a distance of 50–100 yards. Such solitary adults were found in a number of localities in the Nema district, and their presence is considered a definite proof that this is an area in which the species occurs permanently. It lies in the intermediate zone between the Saharan and the Sahelian botanical regions, and the distribution of solitary locusts in it is discontinuous. The actual habitats in which the locusts have been found are described in some detail, particularly as regards their vegetation and soil, which was always sandy. The southern limit of the permanent area is placed about 6 miles south of Nema, while its northern boundary is probably formed by the very sparsely overgrown sands of Djouf.

The conditions of climate and vegetation in most of the localities where solitary locusts were found do not seem to be favourable for a transformation into the gregarious phase, and further investigation is necessary for the discovery of other permanent breeding-places that may be more suitable.

RUNGS (C.). **Observations préliminaires sur la résistance au froid de *Schistocerca gregaria* Forsk.**—*Rev. Path. vég. Ent. agric.* **20** no. 9–10 pp. 314–322, 5 refs. Paris, 1933. [Recd. May 1934.]

In experiments with adults of *Schistocerca gregaria*, Forsk., ph. *transiens*, taken in January and February from swarms in Morocco, exposure for not more than 10 hours to a temperature as low as −5°C. [23°F.] did not in any way affect their subsequent behaviour and development. Even after being frozen quite hard, they gradually became normally active and even able to pair and lay eggs. Exposure for more than 10 hours was fatal.

These experiments help to explain observations made in 1932 and 1933 during the passage of swarms across the Atlas mountains, when locusts encountering a low temperature at a high altitude became inactive and dropped to the ground, but revived next morning as soon as they were warmed by the sun. If the weather continued cold and cloudy, however, they sometimes died. Moreover, if a locust settled on the surface of the snow while its body temperature was still fairly high owing to the flight, it melted the snow round it and slowly sank into

it. In the meantime its body temperature became equal to that of the snow, and a crust of ice formed round it and caused its death. Several swarms have been found dead under such conditions. Hoar-frost, on the other hand, cannot produce any lasting effects.

Arnault (—). **Les criquets à Laghouat en 1933.**—*La Terre et la Vie* **4** no. 4, pp. 219–223, 6 figs. Paris, April 1934.

The Laghouat district, in the Algerian Sahara, was invaded in 1933 by exceptionally large swarms of *Schistocerca gregaria*, Forsk. The eggs were laid early in April, and the hoppers, which hatched at the beginning of May, caused great damage. Date, fig, grape-vines and *Ailanthus* were attacked, but tamarisks and pines were scarcely touched. New adult swarms flew away in a northerly direction.

Delassus (M.), Lepigre (A.) & Pasquier (R.). **Les ennemis de la vigne en Algérie et les moyens pratiques de les combattre. Tome I. Les parasites animaux.**—*Bibl. Colon. Afr. N.* Med. 8vo, viii+249 pp., 115 figs. Algiers, 1933. Price *Fr.* 32.

This practical handbook for the use of vine-growers in Algeria comprises separate chapters on the individual pests of the vine, almost all of which are insects. The principal species are described and illustrated, and notes are given on their biology and control, special stress being laid on the peculiarities that they present under the climatic conditions prevailing in Algeria. A comparative study has been made of alternative control measures, and advice is given as to the method to be selected under given conditions.

Les pulvérisateurs.—[*Morocco*] *Dir. gen. Agric. Comm. & Colonis., Défense des Végétaux* no. 7, 2nd edn, [4] iv+101 pp., 64 figs. Rabat, 1934.

This detailed account of spraying equipment of all kinds as used in Morocco includes discussions of the cost of working and the methods of application of various materials. The factors governing the effectiveness of spray applications are discussed at length.

Melis (A.). **Il grillastro crociato** (*Dociostaurus maroccanus*, **Thunb.**) **e le sue infestazioni in Sardegna.**—*Atti R. Accad. Georgofili* (5) 30 pp. 399–504, 11 figs., 6 pls., 3 maps, 8 pp. refs. Florence, 1934.

The history of locust outbreaks in Sardinia is reviewed. The author considers it possible that swarms of *Dociostaurus maroccanus*, Thnb., which is much the most important species, may occasionally migrate to the Island from Africa and quotes some old records to that effect, but the analysis of several outbreaks shows that permanent breeding areas exist in the northern part of the Island itself, particularly along the upper and the middle courses of the rivers Coghinas and Tirso.

Detailed descriptions are given of all stages in the development of this locust and of *Calliptamus italicus*, L., which is also sometimes injurious in Sardinia, and the life-history of the former is described. In the laboratory, 91–102 eggs were laid by one female, in three successive batches. Observations on oviposition in nature are described in great detail.

The development and the regression of the outbreaks of *D. maroccanus* in Sardinia depend, apart from climatic influences, on the activities of parasites. An account is given of the life-history of the two most important of these, *viz.*, *Blaesoxipha lineata*, Fall., which attacks the adult locusts [*cf. R.A.E.*, A **22** 76], and *Bombylius variabilis*, Lw., which infests the egg-pods. Other parasites include *Blaesoxipha* sp., *B. laticornis*, Mg. (*grylloctona*, Lw.), *Sarcophaga* sp., *Anthrax* sp., *Mylabris* sp., *Trombidium* sp., and hair-worms (Gordiaceae).

The usual methods of control are discussed in the light of local experience, and it is concluded that spraying with sodium arsenite and the use of poisoned baits are particularly suitable. A constant supervision of the permanent breeding areas would enable outbreaks to be suppressed in their early stages.

Zucchini (M.). **La lotta antiacridica in provincia di Cagliari nel 1933.** [The Anti-locust Campaign in the Cagliari Province in 1933].—*Agricoltura Sarda* **13** pt. 1 pp. 21–31, 9 figs., 1 map. Cagliari, 1934.

In 1933, about 38 sq. miles in the Province of Cagliari, Sardinia, were infested by *Dociostaurus maroccanus*, Thnb. During the campaign, nearly 18 tons of cresosol [*cf. R.A.E.*, A **21** 124; **22** 192] and 68 tons of sodium arsenite (employed in baits and as a spray) were used, and about £3,000 [at par] expended on the labour. The crops were saved, but the danger is not yet over, and recommendations are made for the organisation of future campaigns. Since the cost of poisoned baits for a given area proved to be only 71 per cent. of that involved in spraying with sodium arsenite, the former method is preferable.

Borg (P.). **A Queer Disease of the Orange.**—*The Times of Malta* reprint 1 p. Valetta, 15th March 1934.

Larvae of *Ceratitis capitata*, Wied., have been found capable of pupating and overwintering in Malta in the dry pulp of oranges [*R.A.E.*, A **20** 668] that shrivel on the trees from January to about mid-March owing to drought or over-production of fruit in the preceding summer. The pupal period may be extended to several weeks or even to 2–3 months. The larvae cannot escape from the fruit to pupate owing to its thickened rind, and the flies cannot emerge until it falls and rots at the beginning of the new season or until an opening is effected through some cause. The collection and destruction of such fruits, which if infested appear streaked with green, will considerably reduce the numbers of flies appearing early in the following summer.

Ciferri (R.). **Associazione tra larve della mosca delle frutta** (*Ceratitis capitata*) **e un coccobacillo** (*Escherichia ellingeri*). [The Association between Larvae of *C. capitata* and a Coccobacillus.]—*Lav. R. Ist. bot. Palermo* **4** pp. 168–200, 3 figs., 2 pls., 26 refs. Palermo, 1933. (With a Summary in English.) [Recd. April 1934.]

Citrus fruits infested by *Ceratitis capitata*, Wied., in Sicily were always infected by a bacterium, apparently *Escherichia* (*Coccobaccillus*) *ellingeri* [*R.A.E.*, A **17** 213]. It appeared to be a symbiont, but may become pathogenic to the larva under favourable conditions.

Monastero (S.). **L'importanza dell' *Opius* nella lotta contro la mosca delle olive.** [The Importance of *Opius* in the Control of the Olive Fly.]—*Atti Acc. Palermo* (3) **18** no. 2 pp. 283–294, 9 refs. Palermo, February 1934.

Opius siculus, Monastero [*R.A.E.*, A **22** 51], obtained in Palermo from olives infested with *Dacus oleae*, Gmel., or from puparia of the fly, was bred by the author at a temperature of 15–20°C. [59–68°F.]. The life of the adults was short, even if they were fed on sugar-solution ; of those that emerged between 10th and 27th February, the last died on 16th April. They did not seem very sensitive to variations in temperature, surviving in a cage out of doors from October to early December. Moreover, from some hundreds of puparia of *D. oleae* placed in a refrigerator and kept at freezing point, 18 flies and 3 examples of *O. siculus* emerged, and the latter lived 8 days at that temperature. Up to the time of writing, 12,572 puparia of *D. oleae* have produced 1,724 adults of *Dacus* and 1,162 of *Opius*.

d'Ancona (U.) & Nannizzi (A.). **Osservazioni biologiche sull' *Hyponomeuta padellus* L.** [Biological Observations on *H. padellus*.]—*Riv. Biol.* **16** no. 1 pp. 47–60, 5 figs., 19 refs. Florence, February 1934.

In May 1932, a tree of *Prunus mahaleb* in the Botanical Garden in Sienna and plums (*P. domestica*) growing in a neighbouring orchard were both infested with *Hyponomeuta*. The moths differed slightly, but both forms may probably be regarded as biological races of *H. padellus*, L. On *P. mahaleb*, the infestation was limited to one tree by spraying the others with lead arsenate and a nicotine insecticide. On 29th June, the larvae descended to the trunk and grass round it. Many were infested by a fungus, *Beauveria densa*, and others were parasitised by *Pimpla* sp. The infestation was so intense as to destroy all the foliage before the larvae were full-grown, so that many of them died. In May 1933, when the tree put forth new leaves, it was again infested, but much less than in 1932.

Rocci (U.) & Turati (E.). **Le Leucanidi del gruppo *zeae* Dup. e la cosidetta " nottua del granoturco." I–II.** [The Species of *Cirphis* of the Group *zeae*, Dup., and the so-called " Maize Noctuid." Parts I–II.]—*Mem. Soc. ent. ital.* **12** (1933) pp. 273–293, 5 figs. ; **13** pp. 5–22, 2 figs., 44 refs. Genoa, March 1934.

The first part of this paper is a revision of the Palaearctic species of *Cirphis* (*Leucania*) of the group of *C.* (*L.*) *zeae*, Dup., and the second deals with the nomenclature, morphology and biology of the Italian species of the genus *Sesamia*. The main conclusions as to the species injurious to maize in Italy are the same as in a paper already noticed [*R.A.E.*, A **21** 642].

Couderc (J.). **Etude monographique de la cécidomyie de la violette.**—*Bull. Soc. Hist. nat. Toulouse* **65** no. 2 pp. 193–279, 109 figs. Toulouse, 1933. [Recd. April 1934.]

The following is taken from the author's summary of this detailed study of the morphology, internal anatomy and bionomics of *Dasyneura* (*Perrisia*) *affinis*, Kieff., all stages of which are described :

The eggs are laid in the rolled edges of the outermost leaves of cultivated violets and in those of the terminal rosette ; no attack on the flowers was observed. In the neighbourhood of Toulouse there are 5 generations annually, but in the Alpes-Maritimes the generations overlap to such an extent as to be indistinguishable. The larval stage lasts about 6 weeks with about 4 moults ; the pupal stage lasts about 10 days, and the adult is short-lived. The larvae live gregariously within the galls (rolled leaves) ; they construct cocoons of compact silk, not of woven filaments, and do not reproduce paedogenetically [*cf. R.A.E.*, A **16** 300]. The adults are feeble and feed on liquids. Unmated females never oviposit.

Another Cecidomyiid found on violet is partly described from two females. The author considers it probable that the species described by Raymond as *Cottia violarum* [**16** 299] is actually a Mycetophilid (which he describes) living in association with the roots. *D. affinis* was parasitised at Toulouse by a Proctotrupid and in the Alpes-Maritimes by a Pteromalid. Nematodes and *Tetranychus telarius*, L. (*bimaculatus*, Harv.) were found in its galls. None of the chemicals hitherto tried has proved effective in its control, but heat and intense light appear to be unfavourable to it.

Manninger (G. A.) & Manninger, jr. (G. A.). **Das Leben der Getreidewanze, die von ihr verursachten Schaden und Vorschläge über ihre Bekämpfung.** [The Life of the Cereal Bug, Injuries caused by it and Suggestions for its Control.] [*In Magyar.*]—*Mezög. Kutat.* **6** no. 1 pp. 1–35, 16 figs., 22 refs. Budapest, 1933. (With a Summary in German.)

In 1931, serious damage to wheat was caused in some districts in Hungary by the Pentatomids, *Eurygaster austriaca*, Schr., *E. maura*, L., and *Aelia acuminata*, L., which have only recently been recorded as pests there. At the beginning of April the adult bugs fly in swarms from mountains to wheat fields, where they feed for 2–2½ months. One female lays about 180 eggs, in batches of 14, on young plants sown in the autumn or early spring. The bugs of the new generation (which mature after five moults) remain on the wheat till the end of July or beginning of August (harvest time), when they migrate to the southern slopes of mountains. There they aestivate and hibernate under grass and fallen leaves in felled areas or glades, avoiding densely wooded places [*cf. R.A.E.*, A **21** 433, etc.].

Young shoots of wheat die early in spring as a result of the feeding of the bugs, which probably introduce a proteolytic enzyme into the plants. The ears of many infested plants are killed and turn white, and those that are punctured while still in the haulm fail to develop. The quality of the wheat and the flour from it is depreciated owing to the feeding of the bugs on the milky grains, even if only 5 per cent. are punctured.

About 86 per cent. of the eggs were parasitised by the Scelionids, *Microphanurus semistriatus*, Nees, and *Telenomus sokolowi*, Mayr, and from 6 to 12 per cent. of the bugs by four Tachinids.

Since control is impossible in the wheat field, it has been planned to destroy the adults in spring or autumn in their hibernation quarters, where they concentrate on comparatively small areas. The artificial breeding and liberation of *Telenomus* also merits consideration.

GÖMÖRY (S.). **Ueber die Verwüstung von Weizen durch Getreidewanzen.** [On the Injury to Wheat by Cereal Bugs.] [*In Magyar.*]—*Mezög. Kutat.* 6 no. 5–6 pp. 169–195, 7 refs. Budapest, 1933. (With a Summary in German.)

Extensive damage was caused to wheat in Hungary in 1930 by Pentatomids [see preceding abstract], but infestation has since become much less severe. Tables are given showing the results of comparative analyses in 1930–32 of sound and damaged wheat from various districts, indicating the weight and the contents of carbohydrates, albumen, moisture, etc. It was found that the quality of the moist gluten was greatly reduced, though the depreciation is not of practical importance unless infestation reaches 8–10 per cent. The earlier the plants are attacked, the smaller are the grains and the poorer the quality of the gluten. Injury is therefore increased by early sowing and late ripening.

MANNINGER, jr. (G. A.). **Einige neuere Beiträge betreffend die Getreidewanze.** [A few new Contributions relating to the Cereal Bug.] [*In Magyar.*]—*Mezög. Kutat.* **6** no. 5–6 pp. 195–196. Budapest, 1933. (With a Summary in German.)

The following is taken from the summary: Fewer adults of *Eurygaster austriaca*, Schr., and *Aelia acuminata*, L., withstood the winter in 1932–33 in their hibernation quarters in the mountains near Budapest than in preceding years. Though they were abundant on wheat towards the end of April, the numbers did not increase, but remained much smaller than in 1932. This was probably due to cold and damp weather in May, which was unfavourable to pairing and protracted the development of the eggs and nymphs. Of the parasites, *Telenomus* was reared artificially and overwintered successfully.

BODO (F.). *Aphelinus mali* **im Burgenlande heimisch?** [Does *A. mali* occur naturally in the Burgenland?]—*Neuheiten PflSch.* **27** no. 1 pp. 1–7. Vienna, March 1934.

Although *Aphelinus mali*, Hald., was only introduced into the Burgenland, eastern Austria, from the southern Tyrol in September 1932, it was found in 1933 about 10 miles away from the nearest point of liberation, and also in another locality, and is therefore believed to have been present before 1932. It has also been observed there that the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] was more abundant in orchards sprayed with a tar distillate, presumably owing to the destruction of the parasite.

RUSZKOWSKI (J. W.). **Tableau comparatif des essais faits en Pologne pendant les années 1919–1930 sur l'efficacité de divers produits chimiques employés dans la lutte contre les ennemis des plantes.** [*In Polish.*]—*Roczn. Ochr. Rosl.* (B) **1** fasc. 4 pp. 3–54. Warsaw, 1933. (With a Summary in French.) [Recd. April 1934.]

This summary of reports received from various experiment stations in Poland presents in tabular form the results of tests of a number of insecticides (mostly proprietary) against various pests of cultivated crops. It is divided into two parts, the first of which deals only

with Aphids. Alphabetical lists of the pests are appended, with indications of the materials used against them, and brief notes are given on the effectiveness of the more important preparations tested.

Ruszkowski (J. W.). **Les résultats des recherches sur la faune nuisible en Pologne d'après les materiaux des années 1919–1930.** [*In Polish.*]—*Roczn. Ochr. Rosl.* (B) **1** fasc. 1–3 pp. 1–567, 664 refs. Warsaw, 1933. (With a Summary in French.) [Recd. April 1934.]

This is a compilation of data on animal pests of plants in Poland that have appeared in the Polish literature and unpublished manuscripts during the 12 years ending 1930. They are arranged in systematic order under the plants, etc., attacked, the latter being divided into five categories, *viz.*: vegetables, field and forage crops, and pastures; fruit trees, nuts, vines and small fruits; ornamental plants and weeds; forest trees; and stored products. Notes on the local incidence of the various pests and the damage they have caused are given under the 16 Polish Districts, references being made to the bibliography, in which the unpublished manuscripts are marked with asterisks. Indices to the pests and food-plants are included.

[Dekenbakh (K. N.) **Декенбах (К. Н.). Calcium Polysulphides or Lime-sulphur Decoction as a Means of controlling Pests and Diseases of Plants. Experiments of 1924–1930 Part 1.** [*In Russian.*]—Demy 8vo, 88 pp. 2 figs., 62 refs. Simferopol, Kruimsk. gosud. Izdat. [Crimean St. Pub.], 1931. Price 45 *kop.*

[Dekenbakh (K. N.).] **Декенбах (К. Н.). Calcium Polysulphides as a Means of controlling Pests and Diseases of Orchards. Experiments of 1930 with Polysulphides made of Crimean Sulphur. Part II.** [*In Russian.*]—Demy 8vo, 47 pp., 2 pls., 4 refs. Simferopol, Kruimsk. gosud. Izdat. [Crimean St. Pub.], [? 1932.] Price 45 *kop.* [Recd. April 1934.]

Lime-sulphur is not only cheaper than Bordeaux mixture, but acts as an insecticide as well as a fungicide. The first of these two books contains six papers dealing with the use of lime-sulphur as a fungicide in the Crimea and two others that have been noticed from another source [*R.A.E.*, A **15** 477].

The second book, which is devoted to tests of calcium polysulphides manufactured from sulphur obtained in the Crimea, comprises five papers, three of which deal respectively with the preparation of the solution, the correct time and method of the application of dormant and summer sprays, and the causes of scorching and means of avoiding it, and one with the control of a fungus on peach. The fifth (pp. 25–40), entitled "The Pear Leafhopper (Psylla) and a special Method for its Destruction," comprises an account of spraying experiments in the southern Crimea in 1930 against the eggs and newly hatched nymphs of *Psylla* sp. on dwarf pear trees. Three sprays were applied, the first on 20th–23rd April, when the flower-buds had just separated in the inflorescences (pre-pink stage), the second on 7th–10th May (petal-fall), and the third on 12th–17th July. Some trees were sprayed with 2½ gals. lime-sulphur (32°Bé.) and 2 lb. lead arsenate in 100 gals. water, some with the special treatment, which consisted in omitting the lead arsenate and doubling the concentration of lime-sulphur in the first

spray, and some with Bordeaux mixture. The percentage of infestation was 81·05 on untreated trees, 47·69 on those sprayed with the usual lime-sulphur spray, 45·37 on those sprayed with Bordeaux, and 30·76 on those receiving the special treatment, which caused no scorching. In another series of experiments, an estimated percentage infestation of 12·5 was reduced to 0·28 by the special treatment ; lime-sulphur (1 : 40) and Bordeaux mixture reduced it to 8·53 and 5·25 respectively. The total weight of fruit from trees treated with the special spray was almost twice that of the control trees, though the actual number of pears was only slightly higher. The mean percentage of scorched fruit was 1·5–1·7, as compared with 67 per cent. of those sprayed with Bordeaux mixture. Scorching may be avoided by slightly reducing the concentration of lime-sulphur and by not spraying during the hottest part of the day.

[Rodd (A. E.), Gussakovskiĭ (V. V.) & Antova (Yu. K.). **Родд (A. E.) Гуссаковский (В. В.) и Антова (Ю. К.). Pests of Bogara Crops in Central Asia.** [*In Russian.*]—Demy 8vo, 156 pp., 87 figs., 5 refs. Moscow, Ob'ed. gosud. Izd. Sredneaz. Otd. (Saogiz) [Amalgam. St. Pub. Cent. Asiatic Sect.], 1933. Price 2 *rub.* [Recd. April 1934.]

This handbook, which is partly based on the literature and partly on personal observations, comprises notes on the morphology, bionomics, distribution and (in some instances) control of a large number of insect pests of crops grown on non-irrigated land (" bogara ") in Central Asia. Many of the very common insects specific to certain crops are absent or scarce in the non-irrigated land, the predominant pests being polyphagous species that formed part of the original fauna. Keys are given to many of the insects in the stage in which they attack the plants, based on their morphological characters and the injury caused. Indices to the Latin and Russian names of the pests are appended.

[Yakhontov (V. V.).] **Яхонтов (В. В.). The Alfalfa Weevil or Phytonomus (*Phytonomus variabilis* Hbst.).** [*In Russian.*]—Demy 8vo, 240 pp. 77 figs. 14 pp. refs. Moscow, Ob'ed. gosud. Izd. Sredneaz. Otd. (Saogiz) [Amalgam. St. Pub. Cent. Asiatic Sect.], 1934. Price 5 *rub.* 25 *kop.* (With a Summary in English.)

The synonymy and systematic position of *Hypera* (*Phytonomus*) *variabilis*, Hbst., are discussed, and keys are given from the literature to the subtribes and genera of the tribe Hyperini and the 85 species of *Phytonomus*, which the author regards as a distinct genus. He considers that *H. variabilis* originated in Central Asia, where lucerne has been cultivated since ancient times. Experiments showed that the larvae prefer varieties of lucerne from western Central Asia to those from Europe, and the climate of the former is more favourable to outbreaks of the weevil. At least 44 species of the genus occur chiefly in the areas bordering on the Caspian, Black and Mediterranean Seas between 30 and 45°N. Lat. The world distribution of *H. variabilis* is discussed at length. Optimum conditions for outbreaks occur in dry regions where the temperature in early spring rises periodically above 12°C. [53·6°F.] and later does not exceed 25°C. [77°F.].

A separate chapter (pp. 78–98) deals in detail with the morphology of all stages and the anatomy of the larvae and adults, and 80 pages

(99–178) are devoted to an account of the biology and ecology, personal observations [*cf.* **19** 728] being supported by data from the literature. In Uzbekistan, there is one generation a year. The young adults overwinter in the soil, and hibernation also sometimes occurs in the egg stage. At 12°C., the weevils reappear on the surface, feed and oviposit, but return to the soil if the temperature drops. In the field they were unaffected by heavy spring showers, and in the laboratory by 100 per cent. relative humidity maintained for 24 hours. During periods of temporary reactivation in winter they feed on completely dry leaves of lucerne, and in spring on the young green shoots, but do not cause serious damage. One female lays from 1 to 77 eggs a day ; in captivity, the total varied from 1,270 to 2,414, the largest numbers being laid on warm days. They are laid singly or in masses up to 22, sometimes in the leaf-sheaths of lucerne, but usually in the stems. The egg stage varied from 10 days at 22°C. [71·6°F.] to 18 at 17·6°C. [63·68°F.]. The larvae from eggs laid in autumn or during warm weather in winter occur very early in the spring when lucerne is just beginning to sprout and before the overwintered adults appear.

In the first instar, the larvae are very active and, if hatched in dry stems, easily find suitable food in the lucerne field. They settle in leaf-buds or in sheaths of young leaves at the tips of the stems and, when wandering to other shoots or plants, may skeletonise leaves on their way. In the third and fourth instars, they live openly on the leaves of lucerne, this period coinciding with the petal-fall of apple [**19** 728]. They migrate from one plant to another in search of food and are positively thermotropic, though they are able to withstand fairly low temperature and even slight autumn frosts. The larval period varied from 15 days at 22°C. to 28 at 17·6°C. Though the larvae would only feed on other plants in the absence of lucerne, weevils were successfully reared from egg to adult on clover (*Trifolium* spp.), *Melilotus*, *Vicia* and *Lathyrus*. Of 75 varieties and geographical races of lucerne, the Persian variety of *Medicago sativa* was attacked most readily and Central European ones least. A cross between *M. sativa* and *M. falcata* (the least attractive of all) was attacked as readily as *M. sativa*.

The larvae pupate in cocoons in leaves that they roll or web together, or on the soil. The prepupal stage lasted 2–2½ days at 17·6–22°C., and the pupal varied from 6 days at 21·2°C. [70·1°F.] to 10 at 17·6°C. In a thermostat, the life-cycle was completed in 31 days at 22°C. and 56 at 17·6°C. It takes 1–2 days for a young adult to emerge from the pupa. By the time of the appearance of the young weevils, the old ones, which can easily be distinguished by their darker colour, have disappeared from the fields. In Uzbekistan they do not occur later than mid-June. The young adults immediately begin to feed on the leaves and stems. If lucerne is mown, the weevils attack the stems and leaves of beans, cotton [**18** 329], etc., and readily feed on the foliage of *Robinia pseudacacia*, and especially on the stems of *Alhagi camelorum*. At about 25°C., they seek shade and hide under the plants by day. In Uzbekistan, where the night temperature in summer reaches this height, they enter a diapause, flying to orchards, vineyards, growths of weeds, etc., usually within 150 yards of the field, where they shelter under old foliage on the ground. During this migration period, they are readily attracted to light. In Bokhara (western Uzbekistan) they migrate back to lucerne in August. Pairing and oviposition start from mid-September ; some of the weevils, however, do not mature before the beginning of November. A period of

55–60 days with a mean temperature of 12–25°C. is probably required for the completion of sexual maturity. Relatively few eggs are laid in autumn, most of them in dry stems of lucerne. Those laid early sometimes hatch in autumn, but the larvae do not survive the winter.

The natural enemies and diseases of *H. variabilis* are reviewed from the literature. Parasites bred in Uzbekistan from the larvae were the Ichneumonids, *Bathyplectes* (*Canidia*) *curculionis*, Thoms., *B.* (*C.*) *anurus*, Thoms., and *Cryptus* sp., and a Eulophid, *Tetrastichus* sp., and from the adults the Braconids, *Perilitus secalis*, Hal., *P. aethiops*, Nees, *Dinocampus coccinellae*, Schr. (*terminatus*, Nees) and an unidentified species, and the mite, *Erythraeus nemorum*, Koch (*Achorolophus ignotus*, Oudms.). *B. curculionis* parasitised from 36·47 to 61 per cent. of the larvae in 1926–29. The egg stage lasted 3–4 days and the larval 6–7. The parasitised larva constructs a cocoon but does not pupate. The hyper-parasite, *Habrocytus crassinervis*, Thoms., destroyed 5·17 per cent. of this Ichneumonid in 1926 and 50 per cent. in 1928. *D. coccinellae* parasitised 2–12 per cent. of adult weevils in insectaries in Tashkent (eastern Uzbekistan) in May; at 22–25°C., the pupal stage lasted 8 days. *Coccinella septempunctata*, L., is the most important predator on the larvae. A few overwintered adults of this Coccinellid were parasitised by *D. coccinellae*, and more by a Nematode; *Agamermis* sp. The mite, *Notaspis oblonga*, Koch, and the Anthocorid, *Orius* (*Triphleps*) *albidipennis*, Reut., attacked the eggs of the weevil, and the latter also the young larvae in the laboratory. Ants (*Cataglyphis cursor aenescens*, Nyl.) were observed carrying away the larvae of the weevil to their nests. Other enemies were lizards and birds, of which wagtails (*Motacilla* spp.) were especially active. The fungus, *Tarichium phytonomi*, infected from 1·2 to 39 per cent. of the larvae in 1926–29 in Bokhara.

In severely infested fields, the coefficient of injury [*cf.* **14** 285] fluctuates between 39·47 and 89·55 per cent., with an average of 65·35, and the yield of hay is reduced to about one-third. Its value is further reduced by the presence of excreta, which are harmful to cattle. Various conditions affecting infestation and injury are discussed.

The control measures tested by the author have already been noticed [**19** 728]. Lucerne should not be grown in the same field for more than five consecutive years. Flooding in winter will kill a number of the hibernating weevils.

Batiashvili (I.). **Resultate der Untersuchung einiger chemischer Präparate zur Bekämpfung nagender Gartenschädlinge.** [Results of Tests of certain Chemical Preparations for the Control of gnawing Pests of Orchards.] [*In Georgian.*]—Demy 8vo, 21 pp. (133–153), 8 refs. Tiflis [Inst. PflSch. S.S.R. Georg.], 1933. (With Summaries in Russian and German.) [Recd. April 1934.]

The results of laboratory and field experiments carried out in 1931–32 with arsenical and nicotine preparations and sodium fluosilicate against the larvae of *Nygmia phaeorrhoea*, Don., and *Hyponomeuta padellus malinellus*, Zell., are given in tables showing the concentrations used, the percentage of mortality of the larvae and the extent of the scorching. Against both species, the most satisfactory results were obtained with nicotine sprays with the addition of soap, which sometimes killed all larvae of *Hyponomeuta* [*cf. R.A.E.*, A **19** 504]. Arsenicals had practically no effect on *Nygmia*. Nicotine

may be applied at any time of the day in dry weather at temperatures not lower than 16°C. [60·8°F.]. Any type of nozzle may be used in spraying, provided that the whole crown of the tree is well wetted.

BATIASHVILI (I.). **The Apple Moth** (*Hyponomeuta malinellus* **Zell.**). [*In Georgian.*]—Demy 8vo, 57 pp., 11 figs., 91 refs. Tiflis [Inst. PflSch. S.S.R. Georg.], 1934. Price 1 *rub.* 50 *kop.* (With Summaries in Russian and English.)

A detailed account is given of the bionomics of *Hyponomeuta padellus malinellus*, Zell., as observed on apple in Georgia, where it has one generation a year. The life-history is similar to that in Ural'sk [*R.A.E.*, A **19** 288]. The overwintered larvae appear from under the protective coverings of the eggs about the end of April at 14°C. [57·2°F.], but the date of emergence largely depends on the situation of the orchard, the position of the protective shields on the trees and the intensity of sunlight. Some of the larvae penetrate into the young leaves, in which they mine for 8–12 days, while others make their way into the flower-buds and damage the pistil and stamens, so that the flower becomes yellow and dies. The injury caused by the larvae of the second and subsequent instars is described. The pupal stage lasts 13–14 days, as many as 307 cocoons being found in one nest. The adults are on the wing from 28th June to 25th August; females lived 11–53 days and males 8–41. Oviposition begins 7–8 days after emergence, the eggs being laid in batches of 8–109 near the flower and terminal buds on shoots 2–4 years old on the periphery of the crown of the trees. A female deposits 1–3 batches, the total number of eggs laid varying from 22 to 149. The larvae hatch in 18–23 days, but remain under the protective covering, feeding on the bark of the twig and later hibernating.

Of the sprays tested, nicotine and soap was the most effective [see preceding abstract].

GRAINGER (J.). **Virus Diseases of Plants.**—Crown 8vo, viii+104 pp. 5 figs., 6 pls., 445 refs. Oxford Univ. Pr., 1934. Price 6*s*.

This text-book is intended as an introduction to the subject. Separate chapters deal with the relation of a virus to its host plant, the properties of the virus extract, the economic importance and control of virus diseases, their classification (with descriptions of a few selected ones), and experimental work. Chapter iv (pp. 35–43) deals with the general characters and technique of insect transmission, with notes on insect cages, the method of transference of insects, the determination of the incubation period and the duration of the virus in the insect, the method of preparing microscope slides of the vectors feeding on plant tissue, and a test with insects showing that some viruses are filtrable [*R.A.E.*, A **16** 70]. A list of some virus diseases and their specific insect vectors is included.

ASHE (G. H.). **A Note on** *Rhizophagus aeneus* **Richt.**—*Ent. mon. Mag.* **70** no. 839 p. 94. London, April 1934.

Rhizophagus aeneus, Richter, is recorded from the tunnels of *Xyleborus dispar*, F., in an elm lying partly submerged in the River Wye in Wales. This Nitidulid, which may be parasitic, was very numerous.

Roebuck (A.). *Trochilium apiforme* **Cl.** (*apiformis* **Linn.**) **as a Pest on Lombardy Poplars.**—*Ent. mon. Mag.* **70** no. 839 p. 95. London, April 1934.

Examination of Lombardy poplars reported to be severely attacked by borers in Nottinghamshire in June 1932 revealed numerous holes surrounded with particles of wood-dust up to about 8 ft. Larvae of the Cerambycid, *Clytus arietis*, L., were obtained on 12th May 1933 from similar tunnels in many of the smaller branches, which were dead. The principal attack, however, was due to *Trochilium apiforme*, Cl., larvae of which were found by cutting the bark of the trunk for an average of 4 ins. directly upwards from the hole. Adults emerged chiefly between 12th and 17th June, and judging by the abundance of tunnels in the infested trees about one thousand probably appeared from nearly 100 trees during each of the two seasons.

Hille Ris Lambers (D.). **Gegevens over biologie en bestrijding der bietenvlieg. III.** [Data on the Biology and Control of the Beet Fly. III.]—*Meded. Inst. Suikerbietenteelt* **3** no. 3 pp. 111–120, 5 graphs. Bergen op Zoom, June 1933. (With a Summary in English.) [Recd. April 1934.]

Infestation of sugar-beet by *Pegomyia hyoscyami*, Panz., in Holland in 1932 was less severe than in previous years, owing to the heavy mortality of the second generation in 1931 [*R.A.E.*, A **20** 710]. The methods used for breeding the fly for experimental purposes are described. The adults began ovipositing 6 days after emergence, and the egg, larval and pupal stages lasted 5, 11 and 15·5–23·5 days, respectively. It was found that 25·8 per cent. of the eggs hatched normally at 70 per cent. relative humidity [*cf.* **22** 211]. Parasites were the only natural enemies of importance. Of 515 pupae, 253 developed normally, while 224 were parasitised by *Phygadeuon pegomyiae*, Hbm., 35 by *Opius spinaciae*, Thoms., 2 by *O. fulvicollis*, Thoms., and 1 by *Aleochara bipustulata*, L., the total parasitism being thus 50·9 per cent. *Smynthurus viridis*, L., did not attack the eggs in 1932 [*cf.* **22** 83]. As in 1931, *P. pegomyiae* was never obtained from larvae. In an experiment, this Ichneumonid developed from oviposition to adult in 24 days.

de Fluiter (H. J.). **Over het tijdstip, waarop de gewone dennenbladwesp,** *Diprion* (=*Lophyrus*) *pini* **(L.), bestreden dient te worden.** [On the Time when the Pine Sawfly should be combated.]—*Ned. Boschb. Tijdschr.* **7** no. 3 pp. 70–81, 4 figs. Wageningen, 1934.

An investigation on the biology of *Diprion pini*, L., followed outbreaks on pines in Holland in 1929 and 1930 [*R.A.E.*, A **20** 659]. The measures recommended against it in the literature are briefly discussed. In preliminary experiments, which could not be continued owing to the disappearance of the sawfly, a proprietary arsenical dust proved of practical value. It was observed that a dark spot appears close to each eye of the hibernating larva 7–8 days before pupation, and the pupal stage lasted 9–10 days. The adult flights

can thus be easily predicted by examining cocoons collected in March. The minimum period of 16 days indicated by these observations may, however, be prolonged to 24 if the weather is wet and cold. Oviposition begins 1–5 days after emergence, and incubation usually requires 17–20 days. The larvae are gregarious, and during the first fortnight they feed very little. Nicotine, or preferably an arsenical, should be applied at this period, at which very little harm will be done to natural enemies. The most important of these is the Ichneumonid, *Microcryptus subguttatus*, Grav. [**21** 382]. A large number of the eggs of the sawfly are destroyed by a Eulophid, *Closterocerus* sp., and the larvae are attacked by the Tachinids, *Diplostichus tenthredinum*, Br. & Berg., which is specific to *D. pini* but is not numerous, and *Sturmia inconspicua*, Mg., which is more important. These flies appeared 3–4 weeks after the sawfly, and therefore had young larvae always at their disposal.

Buisman (C.). **Verslag van de onderzoekingen over de iepenziekte verricht in het phytopathologisch laboratorium Willie Commelin Scholten te Baarn gedurende 1933.** [Report on the Investigations on Elm Disease at the Willie Commelin Scholten Phytopathological Laboratory at Baarn during 1933.]—*Tijdschr. PlZiekt.* **40** no. 3 pp. 65–87, 7 refs. Wageningen, March 1934.

Experiments in Holland on the transmission of *Graphium ulmi* (Dutch elm disease) by *Scolytus scolytus*, F., to elm seedlings of a strain that had seemed to be resistant to artificial infection were inconclusive, as it appeared probable that the beetles were only very slightly infected with this fungus.

Roepke (W.). **Kort verslag van het iepenziekte-onderzoek verricht op het laboratorium voor entomologie te Wageningen gedurende het jaar 1933.** [A short Report on the Elm Disease Investigations conducted at the Entomological Laboratory at Wageningen during 1933.]—*Tijdschr. PlZiekt.* **40** no. 3 pp. 91–93. Wageningen, March 1934.

The relative abundance of *Scolytus scolytus*, F., and *S. multistriatus*, Marsh., at Wageningen and Haarlem is recorded. The Braconid, *Coeloides* [*scolyticida*, Wesm.] was again numerous at Wageningen (where *S. scolytus* was less prevalent than in previous years), but appeared to be absent from Haarlem [*cf. R.A.E.*, A **21** 172]. Mass-breeding of this parasite was started. The Scolytid larvae developed into adults after remaining for 7 months under water. Submersion for about 3–4 months apparently caused elm bark to lose its attraction for the beetles, but further tests are needed. The bark is apparently suitable for the development of the Scolytids so long as it remains on the trunk. In extensive experiments with chemicals to prevent boring into the bark, a tar distillate appeared to be the best.

In nature, even a small number of infections proved sufficient to kill all the trees of *Ulmus americana* affected and the one example of *U. japonica*. An investigation of the mites infesting the Scolytids revealed two new species, and new Nematodes were also found in the hibernating larvae of the beetles.

SPEYER (W.). **Wanzen (Heteroptera) an Obstbäumen (II. Mitteilung).** [Bugs on Fruit Trees. Second Communication.]—*Z. PflKrankh.* **44** nos. 3–4 pp. 122–150, 161–183, 29 figs., 25 refs. Stuttgart, 1934.

Continued observations on Heteroptera in orchards on the Lower Elbe [*cf. R.A.E.*, A **21** 203] showed that 29 species were present in the spring and summer of 1933, those injurious to apple being *Lygus pabulinus*, L., and *Plesiocoris rugicollis*, Fall. The seasonal abundance of the commoner ones is shown, and the nymphs of several species are described and figured, with comparisons from the literature [**6** 278 ; **11** 580]. A key to the nymphs of the Capsids found is given. The injuries to apple leaves and fruits are described, illustrated and compared with those produced by Bordeaux mixture. It is concluded that species that do not occur on apple before July are harmless. *L. pabulinus* had a second generation on nettle (*Urtica*) and burdock (*Arctium lappa*) beneath the trees, and its winter generation occurred not only on apple but also on oak, birch and privet (*Ligustrum*). Predators and parasites appeared to play a negligible part in checking the bugs. The differences in abundance in the various orchards indicated that tar distillates are effective in control without the addition of mineral oil emulsion [*cf.* **21** 372, 490 ; etc.].

REINMUTH (E.). **Die Beeinflussung des Fritbefalles durch Umwelt und Kultur. Versuchsergebnisse 1933.** [The Use of Environment and Cultivation to influence Infestation by the Frit Fly. Experimental Results in 1933.]—*Z. PflKrankh.* **44** no. 4 pp. 183–185, 1 ref. Stuttgart, 1934.

It is well known that thinly sown plots of oats are very much more severely infested by the frit fly [*Oscinella frit*, L.], and an experiment in northern Germany in 1933 showed that this applies even to early sowing, plots sown thinly on 3rd and 18th April and 3rd May being infested by the first-generation larvae to the extent of 55·4, 75·5 and 73·2 per cent. respectively. Rapid growth is regarded as of great importance in preventing attack, and in a manuring experiment a mixture containing nitrogen and phosphoric acid reduced the infestation by first-brood larvae by 52 per cent., a pure potash manure having little effect by comparison. Temporary checks on development of the oats by rolling, harrowing and hoeing have been stated to increase infestation, and in experiments infestation of plots that were hoed was increased by 13 and 16 per cent.

Bericht der Lehr- und Forschungsanstalt für Wein-, Obst- und Gartenbau zu Geisenheim/Rhein, 1931/32. [Report for 1931–32 of the Viticultural, Pomological and Horticultural Teaching and Research Institute at Geisenheim on Rhine.]—*Landw. Jb. Preuss.* **77**, Ergänzungsband, Spec. pp. 221, 224. 1933. (Abstr. in *Z. Pfl-Krankh.* **44** no. 4 pp. 206–207. Stuttgart, 1934.)

The pests recorded include the Carabids, *Harpalus* (*Pseudophonus*) *rufipes*, Dej. (*pubescens*, Müll.) and *Pterostichus* (*Omaseus*) *vulgaris*, L., on strawberries, *Otiorrhynchus ligustici*, L., on asparagus, *Luperus longicornis*, F., on fruit trees, *Peritelus sphaeroides*, Germ. (*griseus*, Ol.) on young peach shoots, *Anthomyia radicum*, L., on germinating beans, and *Coleophora lineola*, Haw., on *Stachys lanata*.

Loewel (E. H.). **Der Anwendungsbereich des Karbolineums als Winterbekämpfungsmittel im Obstbau, Ergebnisse und Beobachtungen aus den Versuchen des Obstbauversuchsringes des Altenlandes.** [The Scope of Tar Distillate as a Winter Insecticide in Orchards. Results and Observations from the Experiments of the Fruit Experiment Association of the Alteland District.]—*Gartenbauwiss.* **7** p. 496, 4 figs., 1933. (Abstr. in *Z. PflKrankh.* **44** no. 4 p. 208. Stuttgart, 1934.)

Experiments over many years in the Alteland orchard district on the Lower Elbe have confirmed the effectiveness of tar distillate sprays against *Psylla mali*, Schm., *Cheimatobia brumata*, L., *Anthonomus pomorum*, L., and the hibernating eggs of Aphids. Spraying should be delayed as late as possible and a sufficiently high concentration should be used, 8 per cent. being suitable with a good brand. Wet trees take the spray better than dry ones. The Avenarius distillate was the only one that could be combined with a pre-blossom spray of Bordeaux mixture without loss of efficiency by either.

Thiem (H.). **Erfahrungen in der Bekämpfung des Bienenwolfes.** [Experiences in the Control of *Philanthus triangulum*.]—*Dtsch. Bienenz. Theor. Prax.* with *Imker aus Thüringen* **42** no. 1 pp. 13–17; no. 2 pp. 43–47, 6 figs. Berlin, 1934.

The exact distribution of *Philanthus triangulum*, F., in the Werra Valley [*cf. R.A.E.*, A **20** 598] is recorded. Its only natural enemy is the Sarcophagid, *Sphecapata conica*, Fall. (*albifrons*, Rond.), which oviposits in the bees that are being brought by *Philanthus* into its nest. By feeding in these bees, the maggots deprive the Sphegid larvae of their food, so that they die of starvation. Plants attractive to bees should not be grown near the infested area. A radical measure would be the removal of all honey-bees from this area during the flight-period of the Sphegid, *i.e.*, from the end of June to about mid-September. Soil fumigation [*loc. cit.*] is not feasible in the Werra Valley because of the extensive infestation there. Roads and similar surfaces on a firm foundation may be watered with a 25–50 per cent. cold asphalt emulsion, the resultant crust preventing the excavation of nests. When laden with prey, the Sphegid flies so slowly that it can be easily killed. The nesting places should be covered with sticky earth, which seals the nests, or loose stones, which prevent the digging of passages by falling in. Coverings of clay, ballast, etc., have proved effective. Several hundred thousands of the Sphegids have been destroyed, and there has been an improvement in the position of bee-keeping.

Marchal (P.). **Les aphides de l'orme et leurs migrations.**—*Ann. Epiphyties* **19** no. 4–5 pp. 207–329, 3 pls., 52 figs., 5 pp. refs. Paris, 25th November 1933. [Recd. April 1934.]

This important work dealing with the Eriosomatine Aphids living on elms (*Ulmus* spp.) is based on an exhaustive review of the literature and observations made by the author in various parts of France.

The following is largely taken from his summary and conclusions: In order to study the cyclic migrations of these Aphids, the tropisms governing them, and in particular the attraction exercised upon them by the foliage during flight, the author selected, as typical, *Eriosoma*

ulmi, L., *E. lanuginosum*, Htg., and *Tetraneura ulmifoliae*, Baker (*ulmi*, DeG.), which migrate in summer from elm, their primary food-plant, to gooseberry and currants, pear, and cereals, respectively.

E. patchae, Börner & Blunck, of which *E. ulmosedens*, Marchal, is a synonym [*cf. R.A.E.*, A **17** 118], had a complete cycle on *U. campestris*. Winged virginiparae, however, develop in June and July, and there is probably a partial migration, though the intermediate food-plant is unknown [*cf.* **21** 306]. Its life-history is thus transitional between that of species such as *E. rileyi*, Thomas, in the United States, which completes its cycle on *U. americana*, and that of the much more numerous species among which migration is obligatory.

Studies of *E. lanuginosum* showed that this species, which normally lives either on the roots of pear or in galls on elm, may develop entirely on the aerial portions of pear when it is assured of plentiful moisture and constant temperature. The nearest descendants on pear of the alate, gall-forming phase showed the maximum tendency to produce re-migrant alate sexuparae and the minimum tendency to produce apterous forms destined to hibernate and perpetuate the species parthenogenetically on the intermediate food-plant. Similar observations in respect of *E. ulmi* and *T. ulmifoliae* suggest that internal causes chiefly determine the tendency to produce sexuparae, and that this grows less with each succeeding parthenogenetic generation. Each year, in consequence of migration of winged sexuparae to the primary food-plant, the stock on the intermediate food-plant becomes more and more depleted of individuals with sexuparous tendencies, so that within one species two parallel races may gradually develop, one having an exclusively parthenogenetic life-cycle on the intermediate food-plant and the other having an alternating cycle on the two different food-plants. The former race may arise either owing to the disappearance of the primary food-plant from a given area or to increasing isolation on certain parts of the intermediate food-plant such as the roots, which grow progressively deeper as the plant advances in age. On cut elm branches standing in water, stem-mothers of *E. ulmi* developed as far as the fourth instar without forming a gall and were still able to reproduce.

It is recommended that, in regions where subterranean Aphids attack cereals or fruit trees, elms, particularly elm hedges, should not be allowed to grow in their immediate vicinity. Migrations from elm constitute the exclusive or principal source of infestation on cereals. Special care should also be taken to protect orchards containing young trees or bushes from this source of infestation.

TWINN (C. R.). **The Dermestid, *Trogoderma versicolor* Creutzer, a new Pest of dried Milk Products.**—*Canad. Ent.* **66** no. 3 pp. 49–51, 13 refs. Orillia, March 1934.

Trogoderma versicolor, Creutz. (*inclusum*, Lec.) has recently been found infesting several dried milk plants in Ontario; in one, the larvae were discovered in large cracks in the wooden floor and trap-door of a hopper in the drying room. Though the damage caused so far is comparatively slight, this Dermestid is potentially dangerous, and as a result of infestation several shipments of milk powder have been returned. The geographical distribution of *T. versicolor* is briefly reviewed and the life-history outlined from a previous study [*R.A.E.*, A **12** 305]. The infestation found in Canada was probably due to

importation from the United States. As a control measure, wooden floors and platforms in the plants should be replaced by concrete, or unnecessary crevices should be filled with wood fibre or other material. The larvae may be destroyed by thoroughly scrubbing infested floors and other woodwork with an emulsion of kerosene and soft soap in water, to which pyrethrum extract has been added immediately before using. The building should be frequently cleaned with hot water to prevent the accumulation of milk powder dust.

De Leon (D.). **An annotated List of the Parasites, Predators, and other associated Fauna of the Mountain Pine Beetles in Western White Pine and Lodgepole Pine.**—*Canad. Ent.* **66** no. 3 pp. 51–61. Orillia, March 1934.

In addition to a large number of predators, of which the Dolichopodid, *Medetera aldrichi*, Wheeler, was the most important, the parasites of *Dendroctonus monticolae*, Hopk., observed in studies in Montana, Idaho and eastern Washington, were the Braconid, *Coeloides dendroctoni*, Cush. [*R.A.E.*, A **19** 579], which was the most important, and the Pteromalids, *Rhoptrocerus* (*Pachyceras*) *eccoptogastri*, Ratz., which was fairly common in lodgepole pine (*Pinus contorta*) from late June onwards, *Cecidostiba dendroctoni*, Ashm., which occurred in both *P. contorta* and western white pine (*P. monticola*), *C. acuta*, Prov., which was found only in *P. monticola*, and *Rhopalicus pulchripennis*, Cwfd., the adults of which were fairly common on *P. contorta* from about the beginning of June.

In Montana and eastern Washington, the adults of *D. monticolae* emerge during June, July and August from trees killed by their parents the previous season and attack healthy pines. A part of the brood from early deposited eggs rapidly completes development, the adults emerging about the end of August or in September; most of the larvae, however, do not complete their growth until the following spring, pupating chiefly during June. There is, however, considerable variation in the development of the brood, a large percentage of the parent beetles emerging and cutting a second set of egg galleries.

McCarthy (T.). **The Black Beetle.**—*Agric. Gaz. N.S.W.* **45** pt. 3 p. 150, 1 fig. Sydney, 1st March 1934.

The adults of a Lamellicorn commonly known as the "black beetle," and probably a recently introduced species, have caused considerable damage to maize, sugar-cane, and vegetable crops in the coastal districts of New South Wales for the past 4–5 years. They bore into the stems of the plants, chiefly those 3–6 ins. high, just below soil level. The eggs are laid in low-lying, swampy land in which *Paspalum* is growing; the larvae feed on decaying organic material in the soil, but no injury to the grass has been observed. Preliminary experiments indicate that a channel or furrow with vertical sides and with holes at intervals, made between an area of *Paspalum* and any crop likely to be attacked, is an efficient protective measure. Late sown crops are less damaged than early ones, owing to the decline in the numbers of the beetle that begins in November. Cane setts can be protected by dipping them in a mixture of lead arsenate and glue solution. The fields should be ploughed early in autumn, and then left bare until the time of sowing.

PAPERS NOTICED BY TITLE ONLY.

WEBSTER (R. L.). **Division of Entomology** [experiments with substitutes for lead arsenate against *Cydia pomonella*, L., on apple in Washington].—*Rep. Wash. agric. Exp. Sta.* **43** (1932–33) (Bull. no. 291) pp. 30–33. Pullman, Wash., January 1934. [Recd. April 1934.] [*Cf. R.A.E.*, A **22** 216.]

WEBSTER (R. L.). **The Status of Codling Moth** [*Cydia pomonella*, L.] **Control with Insecticides** [in the north-western United States].—*Proc. N.Y. St. hort. Soc.* **79** pp. 33–48. Le Roy, N.Y., 1934. [*Cf. R.A.E.*, A **22** 281.]

MAXSON (A. C.). **Four New Pemphigids** [on *Populus* spp.] **from Colorado (Aphidae Homoptera).**—*Ann. ent. Soc. Amer.* **27** no. 1 pp. 34–42, 4 figs. Columbus, Ohio, March 1934.

MUNRO (J. A.). **Plowing to Control Grasshoppers.**—*Circ. agric. Exp. Sta. North Dakota* no. 52, 4 pp., 3 figs. Fargo, N.D., September 1933. [Recd. April 1934.] [*Cf. R.A.E.*, A **21** 649.]

ZERNOFF (V.). **Sur l'immunité chez** *Carausius* (*Dixippus*) *morosus*.—*C. R. Soc. Biol.* **116** no. 17 pp. 148–150, 1 ref. Paris, 1934.

BALACHOWSKY (A.). **Contribution à l'étude des Coccides de France (17e note). Recherches complémentaires sur la faune de Corse** [including one new species].—*Bull. Soc. ent. Fr.* **39** no. 5 pp. 67–72, 1 fig., 4 refs. Paris, 1934.

BALACHOWSKY (A.). **Contribution à l'étude des Coccides de France. (18e note). Sur un nouvel** *Eriococcus* **de Corse.**—*Bull. Soc. ent. Fr.* **39** no. 7 pp. 98–101, 1 pl. Paris, 1934.

GREEN (E. E.). **On a new Species of** *Targionia* **(Coccidae) from Russia** [on *Populus* in Turkestan].—*Stylops* **3** pt. 4 pp. 95–96, 1 fig. London, 14th April 1934.

MARCU (O.). **Die Ipiden Fauna von Rumänien zusammengestellt.** [A List of the Scolytids of Rumania.]—*Bull. Acad. Roumaine* **16** no. 1–3 pp. 54–60, 41 refs. Bucarest, 1933. [Recd. March 1934.]

SIMMONDS (H. W.). **Biological Control of** *Clidemia hirta* [by *Liothrips urichi*, Karny, in Fiji].—*Agric. J. Fiji* **6** no. 2 pp. 32–33, 1 ref. Suva, 1933. [Recd. April 1934.] [*Cf. R.A.E.*, A **21** 625.]

LEVER (R. A.). **Notes on the Oviposition Habits of two Hymenopterous Egg-parasites** [*Microphanurus painei*, Ferrière, and *Anastatus axiagasti*, Ferrière] **of** *Axiagastus cambelli*, **Dist. (Pentatomidae)** [on coconut in the Solomon Islands].—*Proc. R. ent. Soc. Lond.* **8** pt. 3 pp. 139–141, 3 refs. London, 29th March 1934.

VEITCH (R.). **Banana Thrips** [*Scirtothrips signipennis*, Bagn.] **Control** [in Queensland].—*Qd agric. J.* **41** pt. 2 pp. 124–127, 1 fig. Brisbane, 1st February 1934. [*Cf. R.A.E.*, A **22** 264.]

WEDDELL (J. A.). **Termites (White Ants)** [in Queensland].—*Ent. Leafl. Dep. Agric. Stk Qd* no. 25, 6 pp., 1 pl. Brisbane, 14th July 1933. [*See R.A.E.*, A **21** 570.]

IMPERIAL INSTITUTE OF ENTOMOLOGY.

LIBRARY LACUNAE.

The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.

ANNALS OF THE QUEENSLAND MUSEUM (BRISBANE). Nos. 1, 5 and 6 (1891–)

ANNUAIRE ET MÉMOIRES DU COMITÉ D'ÉTUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (GORÉE) : Vols. I-II (1916–17).

AGRICULTURAL JOURNAL, DEPARTMENT OF AGRICULTURE, BRITISH COLUMBIA (VICTORIA) : Vol. I (1916). Nos. 1 and 2.

AGRICULTURAL NEWS (BARBADOS) : Nos. 1, 25, 26, 34, 66 (1902–04).

ARCHIVES DE L'INSTITUT PASTEUR DE TUNIS :
1906–09 ; 1910, fasc. i–iii ; 1911, fasc. iii–iv.

ARCHIV FÜR SCHIFFS- UND TROPEN-HYGIENE (LEIPZIG) :
Bd. XVII (1913). Hefte, 9, 13 & 14.

ARQUIVOS DO INSTITUTO BACTERIOLOGICO CAMARA PESTANA (LISBON) :
Vols. I–II (1906–10). Vol. III (1911–12) No. 1.

THE BEE WORLD (BENSON, OXON) : Vols. I–II (1919–21).

BIOLOGICAL BULLETIN OF THE MARINE BIOLOGICAL LABORATORY (WOODS HOLE, MASS.) :
Vols. I–II (1899–1901) ; XXIII (1912) ; XXIV (1912) No. 2 ; XXV (1913) Nos. 5–6 ; XXVI (1914) Nos. 1–2 ; XXVII (1914) No. 4 : XXVIII (1915) No. 1 ; XXIX (1915) No. 5 ; XXX (1916) Nos. 2–3 ; XXXI (1916) Nos. 4 & 6 ; XXXII–XXXIII (1917) ; XXXIV (1918) Nos. 1–4, & 6 ; XXXV (1918) ; XXXVI (1919) Nos. 2–3 ; XXXVII (1919) Nos. 4 & 6 ; XXXVIII (1920) Nos. 1, 2, 5 & 6 ; XXXIX (1920) Nos. 4–6 ; XL (1921) Nos. 1–4, & 6 ; XLI (1921) Nos. 2 & 3 ; XLII (1922) Nos. 1–3.

BOLETIN DE LA DIRECCION DE ESTUDIOS BIOLOGICAS (MEXICO) :
Tomos I–II (1924–25).

BULLETIN DU COMITÉ D'ÉTUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (PARIS) : Année 1919, No. 1.

BULLETIN AGRICOLE DE L'ALGÉRIE—TUNISIE—MAROC (ALGIERS).
Année XX (1914). Nos. 7–9, 12–14 and Title-page.

CALIFORNIA AGRICULTURAL EXPERIMENT STATION (BERKELEY, CAL.)
Circulars 14 and 42 (1905–09).

CANADA : DEPARTMENT OF AGRICULTURE : EXPERIMENTAL FARMS :
Fletcher (J.). Reports of the Entomologist and Botanist for the Years 1886 and 1888. (Ottawa, 1887–89).

CHACARAS E QUINTAES (SÃO PAULO) : Indices to Vols. X, XI, XII and XIV.

COMPTES RENDUS DES SÉANCES DE L'ACADÉMIE D'AGRICULTURE DE FRANCE (PARIS) : Tome VIII (1922) No. 5.

EGATEA, REVISTA DA ESCOLA DE ENGENHARIA DE PORTO ALEGRE, BRAZIL :
Vols. I–VI (1916–21) ; VII (1922) Nos. 1–5 ; VIII (1923) Nos. 2–5 ; IX (1924) Nos. 1, 4–6.

ENTOMOLOGICA AMERICANA (BROOKLYN, N.Y.) :
Vol. IV (1888) Title-page. Vol. V (1889), Nos. 6 & 8.

ENTOMOLOGISCHE LITTERATURBLÄTTER (BERLIN) : 6 Jahrg. (1906). Nos. 2 & 10.

EXPERIMENT STATION RECORD (WASHINGTON, D.C.) : Vols. I–IV (1889–94).

GEORGIA STATE BOARD OF ENTOMOLOGY (ATLANTA) :
Bulletin : 2, 6, 22 and 28. Circular : 1 to 3, 12, 15 to 18 and 20.

GRASSI (B.) et al. Contributo alla conoscenza delle Filloserine ed in particolare della Fillossera della Vite. (Rome, 1912).

INDIA : FOREST RESEARCH INSTITUTE (DEHRA DUN).
Indian Forest Records : Vol. I, pts. i and iii.
Forest Bulletin (Old Series) : Nos. 1–3.
Forest Leaflet (Zoology Series) : Nos. 1–2.

INDIAN MEDICAL GAZETTE (CALCUTTA) :
Vol. L (1915) No. 10 ; LI (1916) Nos. 1–7, 10 ; LII (1917) No. 7 and title-page & index ; LIII (1918) ; and LIV (1919) No. 2.

INDIANA : Third Annual Report of the State Entomologist, 1909–10.

JOURNAL OF THE BOARD OF AGRICULTURE OF BRITISH GUIANA (DEMERARA) :
Vol. III (1909–10) No. 1. Title pp. and Indices to Vols. I–II.

JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE (WYE, KENT) :
Nos. 1–6, 8, 10–13, 17–21 (1895–1912).

KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, KY.) :
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 71 (1898) and 91 (1901).

LIBRARY LACUNAE—*cont.*

THE KENYA AND EAST AFRICAN MEDICAL JOURNAL (NAIROBI) : Vol. II, Nos. 2–3 (1925).
NATUURHISTORISCH MAANDBLAD (MAASTRICHT) : Jaarg. I (1912) ; II (1913) Nos. 1–4, 6–9 ; V (1916) Nos. 3–4 ; VII (1918) Nos. 6–9 ; VIII (1919) No. 4.
NEW JERSEY STATE DEPARTMENT OF AGRICULTURE (TRENTON, N. J.) : Bulletin 2 ; Circular : 2, 12, 29 (1917–19).
NEW YORK STATE MUSEUM (ALBANY, N.Y.) : Bulletin : 26 & 57 (1899–1902).
ONTARIO ENTOMOLOGICAL SOCIETY REPORT (TORONTO): 9th (1878).
ORMEROD (E. A.). OBSERVATIONS OF INJURIOUS INSECTS AND COMMON FARM PESTS DURING THE YEARS 1877 & 1878. (London, 1878–79).
PARASITOLOGY. Vol. VI, Nos. 1–3. Vol. IX, No. 1. (Cambridge, 1913–16).
PHILIPPINE AGRICULTURIST AND FORESTER (MANILA) :
Vols. II, Nos. 1–3 (1912) ; III, Nos. 1, 2 (1914) ; IV, No. 4 (1915).
PHILIPPINE JOURNAL OF SCIENCE (MANILA) : Vol. I (1906). No. 10.
PORTO RICO DEPARTMENT OF AGRICULTURE, &C. (SAN JUAN) :
Journal, Vol. I (1917). No. 3.
RECORDS OF THE EGYPTIAN GOVERNMENT SCHOOL OF MEDICINE (CAIRO) : Vol. I.
REVISTA DE AGRICULTURA DE PUERTO RICO (SAN JUAN) :
Vols. I (1918) Nos. 1–2 ; II (1919) Nos. 5–6 ; III (1919) Nos. 3–4 ; VIII (1922) No. 2 ; IX (1922) Nos. 5–6 ; X (1923) Nos. 1, 5, 6.
Indices to Vol. VI and onwards.
REVISTA CHILENA DE HISTORIA NATURAL (SANTIAGO) :
Año XV (1911) Nos. 1 and 3 to end ; XVI and XVIII (1912 and 1914).
REVISTA DE VETERINARIA E ZOOTECHNIA (RIO DE JANEIRO) :
Annos I–II (1911–12). Anno III (1913). Nos. 1 to 3, and 5.
LA REVUE DE PHYTOPATHOLOGIE APPLIQUÉE (PARIS) : Tome I. Nos. 22–23 (April-May, 1914).
RHODESIA AGRICULTURAL JOURNAL (SALISBURY) :
Vols. I–V (1903–08) ; VII (1909–10) Nos. 1 and 6 ; VIII (1910) No. 1 ; IX (1912) No. 5 ; X (1912–13) Nos. 1 and 3.
Title pp. and Indices to Vols. VII, VIII, IX, X.

NOTICES.

Secretaries of Societies and Editors of Journals willing to exchange their publications with those of the Institute are requested to communicate with the Assistant Director.

The Annual Subscription, *in advance,* to the Review, Series A (Agricultural), is 18s. post free ; Series B (Medical and Veterinary), 9s. post free. Subscriptions to the *current* Volume received after 30th June in each year will be charged at the published price *viz.* : Series A, 24s. ; Series B, 12s. Prices of Back Volumes on application.

Orders and subscriptions should be sent direct to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7, or through a bookseller.

CONTENTS.

	PAGE
AFRICA, EAST : The Agricultural Entomology of Italian Somaliland ...	308
AFRICA, FRENCH WEST : *Schistocerca gregaria* in the French Sudan ...	327
AFRICA, NORTH : Observations on *Schistocerca gregaria*	327, 328
AFRICA, NORTH : The Pests of Vines in Algeria (*Review*)	328
AFRICA, NORTH : Spraying Equipment as used in Morocco	328
AMERICA, NORTH : Some Achievements in Economic Entomology ...	275
AMERICA, NORTH : The Spray Residue Problem	281
AMERICA, NORTH : The Problem of *Rhyacionia buoliana*	288
AUSTRALIA : *Ceroplastes destructor* on *Citrus* in N.S.W.	312
AUSTRALIA : A Halticid on Strawberries, etc., in Tasmania	312
AUSTRALIA : *Biscirus lapidarius* predacious on *Smynthurus viridis* ...	313
AUSTRALIA : A Lamellicorn injurious to Crops in N.S.W.	343
AUSTRALIA : The Control of the Banana Thrips (*Title only*)	344

CONTENTS—*cont.*

PAGE

AUSTRALIA : Notes on Termites in Queensland (*Title only*) 344
AUSTRIA : The Danger of Insecticides to Cattle 308
AUSTRIA : The Distribution of *Aphelinus mali* 332
BERMUDA : Miscellaneous Pests in 1931 and 1932 305
BERMUDA : *Comstockiella sabalis* on Palmetto 306
BRITISH ISLES : The Question of Insects and Dry Rot of Swedes ... 273
BRITISH ISLES : A New Parasite of a Bruchid in Sudanese Senna ... 273
BRITISH ISLES : Insects attacking Thistles 274
BRITISH ISLES : *Rhizophagus aeneus* possibly parasitic on *Xyleborus dispar* 337
BRITISH ISLES : *Trochilium apiforme* attacking Lombardy Poplars ... 338
CANADA : Insects of the Season 1932 in Ontario 301
CANADA : Sprays against *Psylla pyricola* and *Aspidiotus perniciosus* ... 301
CANADA : Studies on *Cydia molesta* in Ontario 301, 302
CANADA : The Status and Biological Control of *Pyrausta nubilalis* 302, 303
CANADA : The Grasshopper Campaign in Manitoba in 1932 303
CANADA : Insects infesting stored Grain in Ontario 304
CANADA : A Psocid Outbreak in a Parasite Laboratory 305
CANADA : The Status of *Rhyacionia buoliana* in southern Ontario ... 305
CANADA : *Chermes piceae* in New Brunswick 313
CANADA : A Dermestid infesting dried Milk Plants 342
CORSICA : Studies on Coccids (*Titles only*) 344
FIJI : An introduced Parasite of *Lamprosema octasema* 307
FIJI : Control of *Clidemia hirta* by *Liothrips urichi* (*Title only*) 344
FORMOSA : An Aphid on Sugar-cane 312
FRANCE : *Gryllotalpa gryllotalpa* and its Control 273
FRANCE : A Cecidomyiid attacking Violet 330
GERMANY : Adult Habits of *Nemeritis canescens* 307
GERMANY : Infestation of a House by *Tenebrio molitor* 307
GERMANY : The Control of *Hyponomeuta* on Apple 308
GERMANY : Observations on Heteroptera on Fruit Trees 340
GERMANY : Factors affecting Infestation by *Oscinella frit* 340
GERMANY : Miscellaneous Pests in 1931–32 340
GERMANY : Tar Distillates as Orchard Sprays 341
GERMANY : A Sphegid destroying Bees 341
GUIANA, BRITISH : Miscellaneous Pests in 1932 326
HAWAII : The Bionomics of *Telenomus nawai* 306
HOLLAND : Observations on *Pegomyia hyoscyami* in 1932 338
HOLLAND : Notes on *Diprion pini* and its Control 338
HOLLAND : Observations on Scolytids and Dutch Elm Disease 339
HUNGARY : Pentatomids attacking Wheat 331, 332
INDIA : The Use of an Ant against Termites and Pests of Lac 309
INDIA : Insects associated with Lac Cultivation 309
INDIA : Notes on Honey Bees 310
INDIA : Entomological Investigations on Spike Disease of Sandal ... 311
INDIA : New Genera and Species of Braconids 311
ITALY : Tests of Baits for *Ceratitis capitata* 273
ITALY : Observations on *Hyponomeuta padellus* 330
ITALY : The Identity of Noctuids attacking Maize 330
JAPAN : A Mermithid Parasite of *Chilo simplex* 311
JAPAN : Longicorns attacking *Paulownia tomentosa* 311
MALTA : Pupation of *Ceratitis capitata* in Oranges 329
NETHERLANDS INDIES : The Status of *Xyleborus* spp. as Coffee Pests ... 312
POLAND : Notes on Tests of Insecticides 332
POLAND : A Review of Data on Insect Pests 333
RUMANIA : A List of Scolytids (*Title only*) 344
RUSSIA : Lime-sulphur against Pests and Diseases of Orchards (*Review*) 333
RUSSIA, ASIATIC : Pests of non-irrigated Crops in Central Asia (*Review*) 334
RUSSIA, ASIATIC : *Hypera variabilis* in Central Asia (*Review*) 334
RUSSIA, ASIATIC : Sprays against Lepidoptera in Orchards in Georgia ... 336
RUSSIA, ASIATIC : The Bionomics of *Hyponomeuta* on Apple in Georgia... 337
RUSSIA, ASIATIC : A new Coccid on Poplar in Turkestan (*Title only*) ... 344
SARDINIA : The Bionomics and Control of *Dociostaurus maroccanus* 328, 329
SICILY : A Bacterium associated with *Ceratitis capitata* 329
SICILY : A Braconid Parasite of *Dacus oleae* 330
SOLOMON IS. : Oviposition of Egg-parasites of *Axiagastus cambelli* (*Title only*) 344
U.S.A. : The Association of *Phytomonas melophthora* with *Rhagoletis pomonella* 274
U.S.A. : *Macrosiphum onobrychis* and Mosaic of Lucerne 274
U.S.A. : Delayed Mowing against *Empoasca fabae* on Lucerne ... 274, 277

IMPERIAL INSTITUTE OF ENTOMOLOGY.

Executive Council.

Sir CHARLES J. HOWELL THOMAS, K.C.B., K.C.M.G., *Chairman*, United Kingdom.

Colonel GEORGE P. VANIER, D.S.O., M.C., Canada.

F. L. MCDOUGALL, C.M.G., Australia.

NEVILL L. WRIGHT, F.I.C., New Zealand.

G. W. KLERCK, South Africa.

J. M. ADAMS, F.R.C.Sc. (I), Irish Free State.

Sir BHUPENDRA NATH MITRA, K.C.S.I., K.C.I.E., C.B.E., India.

B. F. WRIGHT, Southern Rhodesia.

R. V. VERNON, C.B., Colonies, Protectorates and Mandated Territories.

Sir DAVID CHADWICK, C.S.I., C.I.E., *Secretary*.

Director.
Sir GUY A. K. MARSHALL, C.M.G., F.R.S.

Assistant Director and Editor.
Dr. S. A. NEAVE, O.B.E.

Assistant Director and
Superintendent of Farnham House Laboratory.
Dr. W R. THOMPSON, F.R.S.

Head Office—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office—41, Queen's Gate, London, S.W.7.